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THE INTERNATIONAL ELECTROTECHNICAL COMMISSION.

As announced elsewhere in these columns, the Sub-committee on Light Standards of the British National Committee of the International Electrotechnical Commission expects to make a satisfactory report upon the question of an international candle. So far as we can learn, no definite steps have yet been taken for a similar representation before the Electrotechnical Commission of the American views on this important subject. While the Illuminating Engineering Society has done excellent work along the lines of that now undertaken by the commission, and originated the plan of securing the collaboration of the gas interest in the effort which it has made to fix an international candle, the society has no formal relations with the commission, which in this country is represented by the American Institute of Electrical Engineers, one of the several national bodies contributing financially to its support. It will be remembered that the standard candle in this country was originally obtained from England and was adjusted into original agreement with the British standard candle. During recent years, Great Britain changed her light standard from the candle flame to the Pentane gas flame. The change has apparently involved a departure of several per cent from the original value of the candle-power, so that America was left with a deviation from the concert of the Powers through no act of her own. In view of the present diversity of luminous standards, including the hefner, Carcel, Pentane candle and the old British candle, still the Bureau of Standards urged, at the instance of the Illuminating Engineering Society, the French sub-committee last year to make a motion in favor of an international candle in the neighborhood of the bougie decimale. The French committee acceded to the proposition and brought the matter up at the council meeting of the commission, in London, last October. No action was taken at the time and the matter was left in the hands of a sub-committee for further consideration.

It is earnestly to be hoped that the report foreshadowed from the British sub-committee may pave the way for the adoption of an international unit of luminous intensity in the neighborhood of the bougie decimale or 10/9 hefners. This international standard might be defined conveniently in terms of national flame standards, but its maintenance should be left to the national standardizing laboratories through the medium of seasoned incandescent lamps, interchanged and intercompared at regular intervals. If the international standard is not maintained by intercomparison of incandescent lamps, it will be likely that after two or three years a new discrepancy will present itself. Thus, if a certain ratio between the various flame standards were forthwith universally adopted as an international candle, and each national laboratory endeavored to maintain this new candle by reference to its own standard flame, it is quite possible that after a few years the international candle as kept in one country might be found to be perceptibly different from that kept in another country, for the reason that flame

standards have not yet shown themselves to be permanently reproducible in different laboratories at different times; whereas it has been found that a batch of well-seasoned and standardized incandescent lamps will probably maintain their rating.

Reflection of Electrical Waves.

When an electromagnet wave runs over the surface of a uniform conducting wire, it obeys very simple laws. The current strength in the wave is equal to the voltage in the wave divided by the surge resistance of the conductor. This surge resistance is the geometrical mean of the linear inductance of the conductor and the linear elastance of the dielectric, provided that the linear loss of power in transmission is very small compared with the power that is being transmitted. The velocity of transmission in such a wave is the velocity of long-wave light in the dielectric. The electric volume energy is at all points locally equal to the magnetic volume energy. The electric intensity in electric units is at all points locally equal to the magnetic intensity in magnetic units. The rate of power transmission at any point on the conductor is the sum of the equal electric and magnetic energies in a slab of the dielectric of unit length, multiplied by the wave speed. When such a wave leaves one uniform line to enter another uniform line, the wave is undisturbed if the surge resistance of the new line happens to be equal to the surge resistance of the old line. If the two surge resistances are, however, unequal, the wave will be broken at the transition point, in such a manner that part of the wave is reflected backward from the junction along the old line, while the remainder is sent on over the new line. The ratio of transmitted to arriving components is commonly called the coefficient of transmission, and the ratio of reflected to arriving components is commonly called the coefficient of reflection. These coefficients are different in the voltage component or electric flux as compared with the current component or magnetic flux. The coefficient of transmission for the voltage component is the ratio of the new surge resistance to the mean of both surge resistances, while the coefficient of transmission for the current component is the ratio of the old surge resistance to the mean of both surge resistances. Consequently, when the wave strikes a new conductor of enormously great surge resistance, such as a very high impedance line, the voltage component approximately doubles, while the current component nearly vanishes. Whether this effect is a mere momentary surge or is sustained to show on a voltmeter, depends on subsequent waves and their resultant summation.

This subject is developed mathematically by Mr. Louis Cohen in his article on page 632 in this number. It will be seen that the final result at which he arrives is that when the inductance of the receiving terminal apparatus is very high, the voltage in the wave transmitted into it may be nearly double the voltage of the original incoming wave. The phenomena involved in wave motion are very swift and difficult to render evident. For the low frequencies of lighting and power distribution, the sportive behavior of electric waves is ordinarily relegated to the limbo of libraries not frequented by the regular student of electrical engineering. When we come to static disturbances on transmission lines, or to the phenomena of wireless telegraphy, Ohm's law is a law of the millennium, and electric wave behavior demands recognition. Formulas such as those set out in Mr. Cohen's paper are thus steadily coming into greater prominence and practical utility.

Twenty-Five Years.

The American Institute of Electrical Engineers is celebrating this week, with a banquet, the completion of its first 25 years of life. It is true that the charter date of incorporation is April 15, 1884, but some steps toward formation had been taken before that time and it was not until May 13 that the first officers were elected. The present date suits the convenience of the Institute for a celebration better than one a little later, and we may fitly regard this week as rounding out the quarter century, upon which the members are to be heartily congratulated. The Institute has indeed had a wonderful growth that was by no means implied in the struggles and difficulties of its first four or five years. At the present moment it is far and away the largest national technical society of its kind in this country; with very few rivals abroad. It had on March 1 no fewer than 6344 full and associate members. The nearest approaches are made by the American Institute of Mining Engineers with 4261 in March and the American Society of Mechanical Engineers with 3260 in January. Happily it is not upon mere numbers, however, that the body is to be congratulated, but upon years of usefulness and upon the acquisition of influence and material resources with which it is placed in a position to do even better work for the art and the profession in the next 25 years. There are many things not yet attempted by the Institute that are well within its province and which if attempted and done well will strengthen its prestige.

Upon this pleasant anniversary, when congratulations are so eminently in order, and when we may especially felicitate those who took an active share in the creation of this great and powerful organization, it seems peculiarly appropriate to make cordial reference to the services of Mr. Ralph W. Pope, who has been secretary continuously since the annual meeting of May, 1885, when the society was only one year old. This loyal and faithful service to the Institute, unmatched as to official connection with the body, except in one instance, has probably been more effective than any other factor in all this splendid growth. With serenity and sanity Mr. Pope has held to the steady tenor of his work through a score of administrations; and while many of the presidents are entitled to great credit for what they did, Mr. Pope deserves more credit than anybody else for the escape of the society from many things it did not do. Unfailingly a conservative and preservative force, Mr. Pope may always look back upon the Institute period now closing with just feelings of personal pride and gratification. And now as the Institute moves forward into its next quarter of a century, we can only hope and believe that from the rising generation of electrical engineers it will enjoy the continuance of the enthusiastic support that since 1884 has contributed to bring it to the preëminence it enjoys to-day, as the youngest but the largest of the four great national engineering societies.

Methods for Starting Induction Motors.

Additional interest in the comparative merits of various methods for starting induction motors, which were discussed in our issue for Jan. 2 and Feb. 25, is given by an article by Mr. Selby Haar and a letter by Dr. C. P. Steinmetz in this issue. Mr. Haar analyzes the performances of squirrel-cage induction motors when started at lowered voltage obtained respectively by means of auto-transformers and of rheostats in the primary circuits. His conclusions are that on the basis of the disturbance

to the supply circuits, rheostats are inferior to auto-transformers, but that on the basis of cost rheostats are preferable. The facts appear to be that the rheostatic starter affects the voltage regulation of the supply line slightly more than does the auto-transformer starter, but it accelerates the rotor to full speed with somewhat less disturbance than does the latter device; it consumes considerable power during the starting period, while the auto-transformer absorbs very little. The determining factor in the selection of the two types should be the relative cost of the energy dissipated by the rheostatic device during the infrequent starting periods throughout its life, and the extra cost of the auto-transformer starter. Probably such a basis, which seems a fair one for comparative purposes, would prove the rheostatic starter somewhat more advantageous than Mr. Haar's article might lead one to believe.

As pointed out in an editorial in our issue for Feb. 25, lowering the voltage impressed upon the primary terminals of an induction motor is similar to decreasing the e.m.f. supplied to both the field-circuit and the armature terminals of a direct-current shunt-wound motor. Such a method is considered unsatisfactory, and use is made, in practice, of a scheme for maintaining full e.m.f. upon the field-circuit terminals while decreasing the e.m.f. across the armature, thereby obtaining the required torque with the minimum of current from the supply system. An analogy to the latter scheme is found in the rheostatic starter used in the secondary circuit of a slip-ring type of motor. As shown by Dr. Steinmetz in this issue, the secondary rheostatic starter used with a slip-ring motor is far preferable to either an auto-transformer starter or a primary rheostatic starter employed with a squirrel-cage motor. It can easily be shown that on the basis of the performance of the three devices, the secondary rheostatic starter is best, the auto-transformer is next and the primary rheostatic starter last—with almost no difference between the latter two. On the basis of initial cost, the auto-transformer starter comes last, with little difference between the two rheostatic types. When compared on the basis of the simplicity of the whole equipment and the initial cost of the motor and starter, the primary rheostatic device appears to be much ahead of the other two.

THE INAUGURAL BLIZZARD, POLE LINES AND WIRELESS.

The situation on Inauguration Day points a moral. It also adorns a variety of lurid tales regarding attempts to find out what was going on and how to get there. A blizzard, poles down, as usual, telegrams at first sent 2600 miles from Washington to New York, via Richmond, Atlanta, Cincinnati and Chicago, and then none at all. Telephone service in the same cheerful condition. Wireless working some, but apparently badly queered, and unable to deliver much except expletives about the weather. It is reported that the government wireless was doing something—enough to worry the commercial wireless—and yet very little news came through that or any other channel. For all the outside world knew, Nihilists might have blown up the Capitol, assassinated the chief officers of state, looted the Treasury and escaped on a captured warship during that period of isolation. Now this sort of thing seems, and is, absolutely without excuse in this twentieth century. With the resources of telephone, telegraph and wireless at command, the isolation of the nation's capital ought to be a thing not only impossible but almost unthinkable. Had the original underground Morse line between Baltimore and Washington been in service, the result would have been different. Have sixty years or so of experience in telegraphy made no greater improvement in reliability than this? Every big storm has practically the same result in interrupting service, the present instance being merely a trifle more complete and sensational than usual. It is high time for radical improvement.

As usually constructed, trunk telegraph and telephone lines are mechanically bad. Their weakness lies in the multiplicity of wires that afford lodgement for snow and sleet and a purchase for wind pressure. The strength of a line is limited by its weakest part, and in lines of this kind the pole becomes the weakest part on account of the very large aggregate of wire strains due to loading and wind on the dozens or scores of wires. If telegraph wires are to be overhead, they should be few in number and pushed to high capacity by modern methods of fast mechanical working. It has been over and over again demonstrated that any one of numerous systems of fast telegraphy can increase the capacity per wire many fold. With a few wires of high tensile strength forming a system designed like a first-class power transmission line, the present volume of business could be done without material risk of interruption from storms. Or taking the other line of operations, the lines could readily be put underground like the military telegraph lines in Germany. Going underground involves some technical inconveniences, yet they cannot be considered very serious with the present resources available. Probably a system entirely underground would be neither necessary nor desirable. It would be quite sufficient if the shorter important links went underground, leaving to well-built overhead lines the bulk of the work. In either case, decreased repairs and less loss of business would go far toward covering the extra expense of installation. The telephone situation should be met in a similar manner by using cables or well-built overhead lines in all important stretches.

As to wireless, there is another story to tell. Taught by experience, wireless companies have learned to dodge overland working as far as possible. Hence in the present exigency they were to a certain extent unprepared. The one available private station in Washington got into communication with the outside only with difficulty, partly perhaps on account of interference with the government wireless service, and did not accomplish much. And just at this point it is pertinent to raise inquiry about the syntonic systems of which we have been hearing for the last five years. All sorts of claims are made for them, and yet when really a critical situation arises they fail to come to the front and do things. It is a pity that better syntonic work cannot in practice be done as yet. The fact seems to be that neither sending nor receiving stations are as yet properly selective, and that the steady tendency in the interest of available energy is to use the longest wave practicable, so that selection must be rather exact to do much good. Even the amateurs are using powerful apparatus now, and the complaint comes from the government stations that they cannot really work comfortably until the amateurs have gone to bed. If the government system is really to be effective, arrangements should be made, not to suppress the experimenters, but to require them to register and take out permits, of course without expense, and to work under government regulation so as to secure a minimum of general interference.

International Electrotechnical Commission.

At the council meeting of the International Electrotechnical Commission, which was opened by Hon. A. J. Balfour, in October last, the question of an international unit of light was brought forward by the French Electrotechnical Committee. The proposition of the French delegates was, however, adjourned in order that committees of the various electrical engineering bodies of the world contributing to the support of the commission might have an opportunity of further studying the subject. The council also recommended that the committee in each country should endeavor to arrange matters in such a way as to satisfy the needs of both electrical and gas industries. Considerable progress has been made here, and the British committee has now appointed a subcommittee under the chairmanship of Dr. R. T. Glazebrook, F.R.S., to go fully into the details of the question. Dr. Glazebrook will be assisted by Dr. S. P. Thompson, F.R.S. (British delegate to the commission); Prof. C. V. Boys, F.R.S., as official representative of the "Gas Referees," and Mr. J. W. Helps, M. Inst. C. E., officially nominated by the Institution of Gas Engineers.

With the cordial co-operation of the gas industry thus obtained, the British subcommittee hopes soon to be in a position to report, especially in view of the experiments lately carried out at the National Physical Laboratory, which point to the probability of an eminently satisfactory solution.

Promise of Great Extensions of New York Subway Traction.

At the hearing before the Public Service Commission of the First District of New York, March 8, upon the proposition made by the Hudson & Manhattan Railroad Company to extend its subway line from the present terminus at Thirty-third Street and Sixth Avenue, up Sixth Avenue to Fortieth Street and thence under Bryant Park and Forty-second Street to the Grand Central Station, considerable interest was created by a proposition made by Mr. Theodore P. Shonts, president of the Interborough Rapid Transit Company. The new route proposed by Mr. McAdoo, of the Hudson & Manhattan Railroad Company, was warmly advocated by many business interests which center in the dry-goods shopping district on Sixth Avenue. There was practically no opposition offered to the plan, although quite a number of citizens from the Bronx and Queens boroughs entered protests upon the theory that the construction of this line might in some way retard the rapid transit plans for their sections of the city.

Mr. Shonts said, when he was placed upon the stand, that his company had no objection to offer to the plans of the Hudson & Manhattan Railroad Company or to the proposals of any other company or to any other plans that would further the advancement of rapid transportation in New York City. He said, however, that the Interborough was preparing plans that would enable it to furnish for the city all the facilities of rapid transportation that would be needed for the next 10 years. He said that these plans, as soon as they had been thoroughly approved by Mr. William Barclay Parsons, the chief engineer of the Interborough, would be submitted to the commission. He would give no details concerning them until they were formally submitted, but he said that the proposal involved the expenditure of $50,000,000 for the work of construction and that of this amount the city would be called upon to raise only $1,000,000. He said that before the plan which he was having drawn up could be put into operation legislation would be necessary in order to provide for the use of private capital in this subway construction.

While no definite information was given out as to the routes proposed in the Interborough plan, it is unofficially understood that they include an underground line from the present subway at Forty-second Street and Seventh Avenue, down Seventh Avenue and through either Varick and Washington or some adjacent streets to a terminus in the neighborhood of the Battery. They also include, so it is understood, an East Side route beginning at the subway at Grand Central Station and extending under Lexington Avenue, or possibly Madison Avenue, into the Bronx, to some outlying terminus not yet selected. It is said that it is the plan of the Interborough to build these routes as extensions of the present subway and under the existing franchise now held by the company. This, it is believed, is the point upon which additional legislation is required.

New Jersey Decision on Trolley-Holding Company.

Chancellor Pitney, of the New Jersey Court of Appeals and Errors, has delivered an opinion placing a limit on mergers by holding companies, which is of general interest on account of the principles set forth.

The case was one involving the control of trolley lines in and around Atlantic City by the Atlantic City & Shore Railway, which in turn is controlled by the Pennsylvania Railroad. The State of New Jersey in instituting the action, challenged the right of the Atlantic City & Shore Railway to acquire and own the stock and bonds of one of the trolley lines or to operate cars over its routes on the ground that such powers were not conferred upon it under the railroad act and cannot be derived from the general incorporation act. This position is upheld by the highest court of the State, and a judgment is ordered ousting the Atlantic City & Shore Railway from the trolley franchises it has acquired and requiring it to dispose of the stocks and bonds.

The opinion states that it must not be forgotten that stock ownership by one company in another is only a mode by which the former company engages in the business of the latter. But since the second company, if the law appealed to by the defendants were unqualified in its effect, might likewise hold stock in any other corporation or corporations, and these might do the same ad infinitum, stock ownership in any company under such a system would not evidence a participation in any definite kind of business, but in effect a participation in a "blind pool" subject to the uncontrolled will of the majority. There would be an end at once of all practical force if the doctrine of incorporation evidences a contract between the State and the corporation or between the corporators and stockholders themselves.

Chancellor Pitney points out in this connection that if the Atlantic City & Shore Railway had unlimited power to purchase stock or bonds in any other corporation it might not only go into the traction business in Atlantic City, but into the mining business in Colorado, or into any other sort of business imaginable and no investor would have the slightest assurance that the money he intended to embark in a railroad enterprise between Egg Harbor and Atlantic City would not be diverted into a multitude of schemes the character or results of which he had no means of telling.

The Chancellor declares his belief that the opinion he expresses of the limitations of the New Jersey corporation law is held by the legal profession in general and that the articles of association of most holding companies are made to express in terms the purpose of holding stocks in other corporations. The power of the Atlantic City & Shore Railway in the matter of holding stock is limited to such enterprises as are necessary and convenient for its declared business of operating a railroad between Egg Harbor and Atlantic City, and the fact that the street railway lines involved in the present litigation are outside of these termini is itself prima facie evidence that the control of their securities is beyond the legitimate functions of the Atlantic City & Shore Railway.

The suggestion that the trolley lines may be controlled because they are feeders for the Atlantic & Shore the court holds to be untenable, and declares that the fact that the operation of a street railway may be indirectly beneficial to a steam railroad in increasing traffic on the latter is not sufficient to bring its operation within the appropriate objects of the latter com-

pany. It is added that the court does not mean to say that by expressing such an object in its certificate of incorporation the Atlantic City & Shore could engage in the trolley business outside its termini, inasmuch as there is a distinct difference in the character of the franchises involved and in the conditions under which they may be exercised.

Indeterminate Franchises for Public Utilities.

Mr. Milo R. Maltbie, member of the Public Service Commission of the First District of New York, has made an extended report to the commission, declaring himself as being strongly in favor of indeterminate franchises for public service corporations. The commissioner believes that this plan meets the objections that are offered to both "unlimited" and "definite term" franchises. He says that the plan has worked well in other places and mentions Boston, Chicago, Washington, the States of Wisconsin and Michigan, the Philippines and Porto Rico. The indeterminate franchise is defined by the commissioner as one the tenure of which runs during good behavior or which may be terminated at anytime by the proper authorities upon the payment of a fair valuation for the actual property taken over. This method, the commissioner says, is the only one whereby a community can always and continuously control its own destinies and can at any time eliminate an objectionable corporation or group of men.

Speaking of the perpetual franchise, Mr. Maltbie says: "At this stage of our political development it is difficult to find any one outside of the direct beneficiaries of franchises who would argue that irrevocable and perpetual grants should be made. Few persons will even attempt to justify the theory which would uphold as binding upon present and future generations a grant made when the Pyramids were erected; yet that is the theory of the perpetual, irrevocable franchise. The streets of a city are not the property of a single generation which it has the right to barter or give away without limit. It would be no more foolish for the city to part with its police power than for it to part irrevocably with its control over the streets. A franchise is justifiable only for so long a time as it inures to the public benefit, and every generation and age should have the power, so far as possible, to work out its own destiny unhindered by limitations unwisely imposed by previous generations."

The limited term franchise, the commissioner believes, is an obstacle to the orderly development of public utilities inasmuch as no one can foresee the exact time when it would become the wise policy to terminate the franchise and in addition as the time for termination approaches the corporations would be tempted to go into politics to protect their interests. He thinks also that limited franchises act as a deterrent to private capital to invest in public utilities.

The indeterminate franchise, in the commission's opinion, removes the obstacles to both of the other plans. In outlining what he considers to be the proper method of granting franchises he says: "The grant should be subject to termination on purchase of the property, either by the city or by another company specially authorized by the city, at a fair valuation. The provision for purchase by another company is necessary because municipal operation may be neither feasible nor desirable. Direct methods are preferable to indirect methods, and if the city has not the power to operate or may be prevented from purchase because of financial disability, there must be a way to transfer the property directly to the lessee company or the right of revocation will be practically worthless. As profits may be small or non-existent during the first few years of a new enterprise, and as some time may be required to get under way and show what can be done, there ordinarily should be an initial period during which purchase may be made only on payment of a prescribed bonus in addition to the actual value of the property taken and possibly a very short period in which purchase may not take place at all, if the scheme is a big one. A similar bonus should be provided for on all new capital expenditures for extending the undertaking, if purchase takes place within a short time after such expenditures have been incurred."

New York Public Service Commission News.

The Public Service Commission of the First District of New York has sent a communication to the Legislature in response to the resolution of inquiry recently adopted concerning the investigation into the 10-cent fare rate to Coney Island. In its response the commission says that the decision has been delayed on account of insufficient information on the question of fares. It says that after the hearings on the subject had been held it was found that the evidence taken did not offer sufficient ground upon which the commission could arrive at a conclusive decision either that a 10-cent rate was reasonable or that a reduction could be ordered. It was found that in order to make such a decision it would be necessary to make an appraisal of the property and franchises of the four elevated and six surface routes that would be affected. Such an appraisal has been determined upon by the commission and will be made just as soon as it is possible to get at the work. The expert force of the office, which is capable of doing such work, it is said, is now fully occupied in making appraisals of railway property in Manhattan and the Bronx. Since the commission has come to this conclusion it is not likely that any decision on the question of fares will be reached in time for the traffic during the coming summer. The appraisal itself will take some time.

The Public Service Commission has issued an order forbidding any employee of the New York Central Railroad to go upon the top of moving cars within the electric zone in the neighborhood of New York City. This is done as a matter of safety on account of the many low bridges and wires which cross the tracks in this district.

The commission has approved the franchise asked for by Receiver Frederick W. Whitridge, of the Third Avenue Railroad, which had been previously allowed by the Board of Estimates, for the construction of 12,000 ft. of double-track road between Westchester Avenue and Classon Point on Long Island Sound.

The commission is determined to push its demand for side-door cars in the subway. It has informed General Manager Frank Hedley, of the Interborough Rapid Transit Company, that it considers the experiments already made as successful, and that if a second train of eight subway cars is not equipped and ready for service by April 1 the company will be called upon to pay a penalty of $1,000 a day for failure to comply with one of the commission's orders.

Indiana Legislature Passes Important Telephone Law.

By the passage of House Bill No. 273, introduced by Representative Wells, the Indiana Legislature has made an important amendment to the statute relating to the power of telephone companies incorporated in the State. The principal provision of the new act provides that any telephone company organized in the State shall have power to acquire by lease or purchase the lines, exchanges, franchises, rights and other property, or any part thereof, of other telephone companies, or to dispose of by lease or sale its lines, exchanges, franchise rights and other property, or any part thereof, and also shall have the power to acquire and hold stock and bonds of other telephone companies.

Until this amendment was made the law did not permit a company organized under the laws of Indiana to hold stock in any other company. On the other hand, the Central Union and other companies organized under the laws of other States have had such right and power. The amended law puts home companies on an equal footing with foreign companies and is expected to stimulate and strengthen the independent system in the State. Already the stock of certain independent companies has advanced several points, and the strong companies will in many localities acquire and take over the smaller companies.

Independent Telephone Merger.

The directors of the United States Telephone Company closed a contract at Cleveland, Ohio, on March 6, with representatives of the Independent Long Distance Telephone & Telegraph Syndicate of New York and St. Louis for operating in connection with the United States Company's lines in Ohio, Indiana, Michigan, New York and Pennsylvania. The contract contemplates the organization of a corporation with a capital of $2,500,000 as a preliminary company to co-operate with the United States Company.

One million dollars of this amount is to be paid in within six months. The formation of the new company will mean an extension of the Independent lines.

Indianapolis Grants Increase of Telephone Rates.

The Indianapolis City Council has ratified the new franchise granted by the Board of Public Works to the Indianapolis Telephone Company and the New Telephone Company, lessee. There was so much opposition developed to the granting of this contract that the Council had it under consideration several months and a number of civic bodies took a hand in its adjustment. Litigation also grew out of the grant and some phases are still pending. The new contract runs for 30 years, and an important provision allows a material increase in the rate for service as well as additional charges dependent upon contingencies and growth of the number of subscribers. The franchise provides that the company shall within the next two years make extensions and improvements to the plant to cost not less than $500,000, and at least one-half of this amount to be expended on the plant within the next year and a half. The work of constructing and equipping a new exchange building is to be under the supervision of inspectors appointed by the Board of Public Works, and the city reserves the right, at a certain period in the life of the contract, to buy the plant at an appraised value. Improvements on the plant will begin at once and the new exchange building started over two years ago will be completed and include a modern and costly switchboard.

Enclosed Fuse Litigation.

On Feb. 19, Judge Lowell, of the United States Circuit Court of Massachusetts, delivered an opinion in a case involving the validity of a patent covering the use of multiple enclosed fuses. In discussing the state of the art the court said that so far as the record is concerned the employment of a porous non-conducting or refractory material as a filling is first shown in an English patent issued to Mordey in 1890, and later in a patent issued to Downes in 1896. However, that Downes had no part in the discovery of the valuable quality that resides in a filling of refractory material, and denied its importance, appears from his statement that "The refractory material without the air drum or space is of no utility. No one uses it or desires so to do." Downes thus shows that he conceived the gist of the earlier patent to lie, not in the employment of refractory filling, which had been earlier employed by Mordey, but in a space unoccupied except by air. The court concludes that the discovery of the value of filling thus appears to have been made by Mordey and certainly was not made by Downes.

The court states that in the case in suit the parties agreed that the combination in the claim contested consists of three elements—namely, first, the enclosing sheath; second, the filling of a porous non-conducting or refractory material within the sheath; and third, a plurality of fusible wires or conductors disposed generally throughout the filling, but not grouped or bundled closely together. The complainant does not dispute that the first two elements are old in the art, both separately and in combination, but contends that the third element is new in combination with the first and second. After discussing at length this latter contention, the court held that the claim made for increased absorption of heat and metal seems obvious in the cases of multiple links in comparison with a single link; and that to divide the single link in an enclosed filled fuse requires only mechanical skill after a single link has been divided in an open fuse, and after it has been placed undivided in an enclosed filled fuse; and Downes has declared that filling is altogether useless except in connection with an air space, and that an air space is not found in the claim in suit nor in the defendant's manufacture. On the whole, therefore, the court considered the claim in suit to be invalid and ordered that the bill be dismissed. The parties of the suit were the D. & W. Fuse Company, complainant, and the Chase-Shawmut Company.

Electrical Development in Mexico.

A number of interesting electrical developments have recently been reported from different parts of Mexico. The most important of these is the project of installing a hydro-electric plant on the Conchos River, in the State of Chihuahua. A syndicate of Canadians who were formerly interested in the Mexican Light & Power Company have organized a company called the Mexican Northern Electric Company to carry out their plans for establishing the new plant in Chihuahua. Mr. G. F. Greenwood, of Montreal, Canada, is president of this company, and he and other stockholders are now in Mexico arranging for the commencement of construction work on the enterprise. He says that more than $5,000,000 gold will be expended in the installation of the initial hydro-electric plant, which will have a capacity of 15,000 hp. The plant will be so constructed that it can be enlarged at any time to meet the demands that may be made upon it for power. It is planned to run transmission lines from the plant to the cities of Parral, Jiminez, Chihuahua and other smaller towns, and to many of the larger mining camps in that part of the country. It is stated that the Mexican Northern Electric Company has a working capital of $15,000,000 gold. Mr. E. B. Greenshields, of Montreal, is vice-president, and Mr. Frank Thompson, of the same city, is secretary of the company.

Another large transaction in the electrical field of Mexico which is now pending is the purchase by the Guanajuato Power & Electric Company of electric light and power plants and the electric street railway system of the city of Guadalajara. These several interests are owned by the Compania de Tranvias, Luz y Fuerza, and are controlled by Mr. Fernando Pimentel, a multimillionaire of Mexico City. The Guanajuato Power & Electric Company, the stock of which is owned principally by Colorado Springs (Col.) men, has made an offer of $8,500,000 for the property of the Compania de Tranvias, Lus y Fuerza. This is in Mexican money, which is equivalent to $4,250,000 gold. The offer carries with it certain stipulations which are now being arranged in order that the deal may be consummated. One of these is that Mr. Pimentel and associates must remove from the field all competing interests. In order to do this the Pimentel people have entered into a combination with Mr. Manuel Cuesta, of Guadalajara, who owns a valuable concession from the Mexican Government for the installation of a hydro-electric plant on the Santiago River and the establishment of an electric street railway system and lighting facilities for Guadalajara, whereby a company with a capital stock of $10,000,000 Mexican money shall be formed to take over and put into operation that part of the Cuesta concession which provides for the installation of a hydro-electric plant and the building of transmission lines to Lake Chapala, where the power will be used for irrigating works. The Guadalajara field will not be invaded by the Cuesta company under the terms of this agreement. The Guanajuato Power & Electric Company recently enlarged the capacity of its hydro-electric plant at El Duro, State of Michoacan. The company is now furnishing power from the El Duro plant for the Guanajuato mining district and city and several other towns of that region, including Irapuato and La Barca. Some of its transmission lines are already more than 100 miles long, and if it enters the Guadalajara field from its El Duro plant its transmission line will be 200 miles or more long.

Missouri Electric Light, Gas and Street Railway Association.

At an executive meeting of the Missouri Electric Light, Gas and Street Railway Association, held on Jan. 22, Springfield, Mo., was decided upon as the next place of meeting, and the dates fixed for April 15, 16 and 17. A program committee was chosen, its work outlined, and a report is expected shortly. Mr. C. L. Clary, Sikeston, Mo., is secretary.

Charlotte, N. C., to Control Public Utility Rates.

By the terms of an amendment to the charter of Charlotte, N. C., the control of rates of public utilities, including telephone service, lighting service, etc., is vested in the Board of Aldermen. The amendment was vigorously fought by all of the local public service corporations, among the points made against it being the great harm entailed when they undertake to borrow money or negotiate loans or sales of bonds, etc. The Board of Aldermen later decided to cut out the unpopular section, but the bill had already passed the Legislature.

Another Addition to Boston Edison System.

The Edison Electric Illuminating Company of Boston has secured control of the Lexington Gas & Electric Company, operating in the historic suburban town of about 4000 inhabitants located 11 miles west of Boston. It is understood that the gas plant will be sold to other interests. The purchase is also understood to be a step in the further consolidation of suburban plants with the Edison system, as recently noted in these columns.

The Lexington plant has a limited distribution area, and is only of a few hundred kilowatts capacity, with little facility for economical power production on a large scale. As a part of the Edison system it will probably serve as a convenient center of distribution for both lighting and railway service in connection with certain of the Boston Suburban trolley properties.

Canadian Electrical Merger.

It is reported in government circles at Toronto, Ont., that a far-reaching electrical merger is being formed, having for its object the protection of the various independent electrical companies threatened with great loss of revenue by the initiation of the government power scheme. With an immense capitalization, it is claimed this company will merge all the companies operating within the confines of Ontario. Where the organizers hope to rival the hydro-electric commission will be in embracing in the merger the radial traction lines of the eastern provinces. Thus the same transmission lines which supply the private users will be tapped also to supply the radial lines. The latter is held to be an extremely profitable business and will be thus denied the hydro-electric commission. This, it is claimed, will put the government at a disadvantage in selling power. The trust will, it is claimed, make great sacrifices if necessary at the outset to coerce the municipalities and the commission.

International Congress of Applied Chemistry.

The provisional organization of the Seventh International Congress of Applied Chemistry, to be held in London, May 27 to June 2, 1909, has been completed and a preliminary program formulated. Among the members of the American Advisory Committee of Honor are Mr. E. G. Acheson and Dr. C. F. Chandler. Members of other American committees are Dr. John Hays Hammond, chairman, and Prof. J. W. Richards, metallurgy and mining; Prof. C. E. Munroe, chairman, explosives; Dr. W. D. Bancroft, chairman, and Messrs. C. A. Doremus, F. A. J. Fitzgerald, L. Kahlenberg, E. R. Taylor and W. R. Whitney, electrochemistry and physical chemistry. Of Section X of the congress, electrochemistry and physical chemistry, Sir John Brunner is president, Mr. G. T. Beilby vice-president and D. F. Mollwo Perkin honorary secretary. The membership subscription has been fixed at £1, which may be forwarded to the honorary general secretary, Mr. Wm. Macnab, 10 Cromwell Crescent, London, S. W.

Kuzel Incandescent Lamp Patents.

Three patents were issued Feb. 9 to Hans Kuzel, of Vienna, Austria, relating to the manufacture of the so-called colloidal tungsten lamp filament. One of the patents is on a process for manufacturing refractory metal alloys. This consists in adding to a colloidal suspension of the metal, such as tungsten, a crystalloid compound such as platinum or titanium chloride or sodium silicate; after mixing the two constituents intimately, a precipitate is added, whereby an absorption compound of the colloid and crystalloid is formed. After the precipitate is brought to a desired shape it is reconverted into the crystalloid state by heating. A second patent is on a solder for connecting incandescent lamp filaments to the leading-in wires, the solder consisting of a carbide of tungsten. The third patent is on a form of spider mounting for a tungsten filament.

A patent granted March 2 to the same inventor relates to a process for the manufacture of incandescent-lamp filaments of an alloy of antimony with one of the refractory metals, such as tungsten, osmium, zirconium, etc. According to this method antimony, either in a colloidal or finely powdered solid state, or as a sulphur or oxygen compound of antimony, is mixed with a plastic mass consisting of a "colloid" of the refractory metal with or without the addition of the metal in a powdered solid state or of colloidal oxygen compounds of the metal. Filaments are then squirted from this plastic mass and when heated to a white heat, the colloids return to the ordinary crystalline form. The filaments then consist of an alloy of the refractory metals and of antimony, the presence of the latter notably increasing the electrical resistance of the filament.

Niagara Pumping Station.

The city of Niagara Falls is to vote on a proposition to establish a new water system, pumping station and filtration plant on March 10. The plan calls for an appropriation of over $700,000, but it is hardly hoped to complete the work with this expenditure. Should the taxpayers authorize the work to go on, the new plant contemplates the abandonment of the present water-pumping station on the hydraulic canal basin. In this site and power rights the taxpayers of Niagara Falls have valuable rights through the foresight of the government of the former village of Suspension Bridge, for it was that village, now a part of the present city, that established the municipal water system, now paying a very large revenue.

In order to determine what is best to do with the rights on the canal basin, the water commissioners interviewed the Niagara Falls Hydraulic Power & Manufacturing Company, which company under recent date has written to the board stating that in consideration of the city releasing and surrendering its lease for power they will make a lease to supply 800 hp at Niagara Street and Riverway for the operation of the new pumping station at $9 per horse-power, and such additional power as the city may require at $10 per horse-power for the period of 76 years, which is the unexpired term of the power lease of the city. Furthermore, the power company offers to make no charge for excess power used by the city for fire pressure for a certain number of fires per month based on the average number of fires per month for the last five years, or a number to be agreed upon by the company and the board. The power company states it will purchase the lot on which the present pumping station is located and pay therefor the sum of $20,000 in cash or apply that amount in reduction of the rate for power at the option of the city.

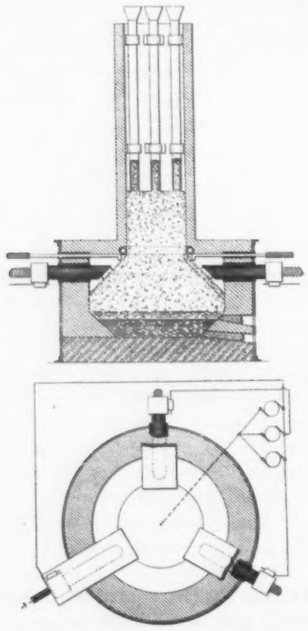
Reduction of Cable Rates.

In a newspaper interview Mr. Gustav Thalberg, of the German South American Cable Company, states that through diplomatic channels he learns that everything has been prearranged by the American Government to enter into the plan suggested by Mr. J. Henriker-Heaton, member of the British Parliament, for the acquisition of the existing ocean cables between Great Britain and the United States by the British and United States governments. This will, he says, result in much lower cable tolls, better service, and an enlargement of Stock Exchange business between both countries. "It should not be forgotten that the first ocean cable was in large part laid at the joint cost of the governments of Great Britain and the United States. Owing to exorbitant ocean cable charges only one-twelfth of the capacity of the cables between here and Europe is employed. These cables are conditioned to carry 300,000,000 words a year. In the past year the business done was less than 25,000,000 words. At 2 cents per word, instead of 25 cents, the cable companies could make more money."

Electric Refining of Steel and Reduction of Iron Ore.

In view of the recent adoption of the Héroult electric furnace by the United States Steel Corporation for steel refining at two of its works, a concise summary of the Héroult process may be interesting. It is purely a process of refining in the electric furnace steel made by the Bessemer converter or open-hearth process. The operation as carried out at the older Héroult plants is as follows:

The process of steel making in, say, the open-hearth furnace is carried somewhat further than in ordinary open-hearth practice, namely, until the phosphorus content has been reduced to the



DIAGRAMS OF HÉROULT ELECTRIC FURNACE.

desired very low extent. Since the phosphorus is in general eliminated after the carbon, this operation of getting rid of the phosphorus also eliminates the carbon and highly oxidizes the steel. This would be very undesirable in ordinary practice, but in the Héroult process this dephosphorized, decarburized and highly oxidized steel is desirable for the electric-furnace process.

When introduced into the electric furnace in the molten state three things occur: the recarburization of the steel to the desired carbon content; the thorough deoxidation of the metal, and the reduction of the sulphur content to the desired degree. For deoxidizing the metal thoroughly the neutral atmosphere of the electric furnace is of decisive importance; this condition is absolutely different from that of ordinary metallurgical practice, where heat production is always accompanied by oxidation. For the desulphurization of the steel the high temperature of the arc is of decisive importance, because the sulphur is eliminated as calcium sulphide, which passes into the highly basic slag, and in this reaction the formation of calcium carbide (which requires a very high temperature) appears to play an important rôle.

The result of the process is a thoroughly deoxidized metal, free from slag, with any desired content of carbon, while the percentages of phosphorus and sulphur are reduced to any desired extent, say each below 0.01 per cent.

Two patents, granted to Dr. Paul Héroult on March 2, refer to details of electric-furnace construction for iron-ore reduction, which, however, is a problem quite different in industrial and technical respects from steel refining. The object is to use fixed carbon electrodes in a three-phase furnace in order to avoid the trouble of sliding electrodes in water-cooled stuffing boxes. Regulation is accomplished by varying the distance of the sliding charge from the electrodes.

The furnace, as shown in the adjoining diagrams, is built as a shaft furnace with three electrodes placed symmetrically through the walls. The metal in the bottom of the hearth forms the neutral point of the three-phase system. The furnace has a base of carbon and side and overhanging walls of clay. The iron ore and carbon mixture is fed through the shaft downwards.

The movement of the charge is regulated by means of three slides, which are adapted to be withdrawn under the edge of the overhanging wall or to be projected sufficiently to move the slope back to the dotted line shown. These slides, for example, may be flat plates (water cooled, if necessary) of a sufficient breadth to cover the electrodes and protect them from the charge at the sides, and may be provided with screws at the outer end for manipulating it.

Furnaces of this type have the great advantage that they may be open at the top. The escaping gases are burned to preheat the charge. Further, the electrode is better protected against consumption than with ordinary construction. However, iron ore reduction in the electric furnace (though technically possible) is commercially impracticable under ordinary conditions, and is not yet carried out anywhere in the world on a large commercial scale.

Chicago Electric Club.

The relation of the technical journal to the industry it upholds was the general subject of the discussion at the weekly luncheon of the Electric Club of Chicago on March 3. "Publishing a Technical Journal" was the subject of the opening address by Mr. A. A. Gray, managing editor of the *Electrical Review and Western Electrician.* Mr. Gray described the practical making of the paper. Those taking part in the discussion were Messrs. Frank L. Perry, formerly business manager of the *Western Electrician;* George Cutter, of South Bend, Ind.; F. N. Sager, of the Arnold Company; J. R. Cravath and William E. Keily, associate editors of the *Electrical World* in Chicago; W. R. Bonham, Sterling Electric Manufacturing Company, and Albert Scheible, president, Ajax Line Material Company, Chicago. The large subject was informally discussed according to the individual views of the speakers, and the importance, usefulness and forms of service of the technical journal were brought out in various aspects. Mr. Eugene Wrigley, of Louisville, briefly presented the claims of the Southern Electrical and Industrial Exposition, which is to be held in the First Regiment Armory, Louisville, April 12 to 24. It was announced that at the meeting of March 10 Mr. Homer E. Niesz, of the Commonwealth Edison Company, would talk about "Central-Station Publicity." The club is flourishing and has about $1,800 in bank.

A. I. E. E. Veterans.

In our issue dated Jan. 2 a list was printed with the above caption giving the names of present members of the American Institute of Electrical Engineers of twenty years or more standing.

This list was received from a correspondent and accepted as correct, but after being printed attention was called by readers to a number of omissions. In view of the celebration the present week of the twenty-fifth anniversary of the founding of the Institute, the list is reprinted below as corrected by a careful comparison with the entries in the 1909 A. I. E. E. Year Book, and with the addition of the dates of transfers to full membership.

1884.

Alexander G. Bell, Washington, D. C.	Transferred in	1884
Adam Bosch, Newark, N. J.	" "	1885
Charles F. Brush, Cleveland, Ohio	" "	1885
Charles L. Clarke, New York, N. Y.	" "	1885
Charles R. Cross, Boston, Mass.	" "	1884
Leo Daft, Rutherford, N. J.	" "	1885
Joseph P. Davis, New York, N. Y.	" "	1904
Patrick B. Delany, South Orange, N. J.	" "	1891
Philip Diehl, Elizabeth, N. J.	" "	1884
Thomas A. Edison, Llewellyn Park, N. J.	" "	1884
Stephen D. Field, Stockbridge, Mass.	" "	1884
George A. Hamilton, New York, N. Y.	" "	1884
Edwin J. Houston, Philadelphia, Pa.	" "	1884
Francis W. Jones, New York, N. Y.	" "	1884
Nathaniel S. Keith, Philadelphia, Pa.	" "	1894
Thomas D. Lockwood, Boston, Mass.	" "	1884
C. O. Mailloux, New York, N. Y.	" "	1884
George C. Maynard, Washington, D. C.	" "	1888
John Millis, U. S. Army	" "	1885
William D. Sargent, Brooklyn, N. Y.	" "	1894
Jesse M. Smith, New York, N. Y.	" "	1891
Elmer A. Sperry, New York, N. Y.	" "	1893
Edward P. Thompson, New York, N. Y.	" "	1889
Elihu Thomson, Lynn, Mass.	" "	1891
William B. Vansize, New York, N. Y.	" "	1884
Edward Weston, Waverly Park, N. J.	" "	1884
Joseph Wetzler, London, England	" "	1884

ASSOCIATES.

Charles L. Buckingham	New York, N. Y.
E. N. Dickerson	New York, N. Y.
Charles A. Doremus	New York, N. Y.
George F. Durant	St. Louis, Mo.
T. Commerford Martin	New York, N. Y.
J. Frank Morrison	Baltimore, Md.
John C. Reilly	Brooklyn, N. Y.
Theodore N. Vail	New York, N. Y.
Charles Williams, Jr.	E. Somerville, Mass.

1885.

E. P. Roberts, Cleveland, Ohio	Transferred in	1885
Schuyler S. Wheeler, Ampere, N. J.	" "	1885

ASSOCIATES.

Ralph W. Pope	New York, N. Y.
Thomas A. W. Shock	York, Pa.

1886.

Edgar G. Bernard, Troy, N. Y.	Transferred in	1887
Alfred H. Cowles, Cleveland, Ohio	" "	1889
Minor M. Davis, New York, N. Y.	" "	1893
Rudolph M. Hunter, Philadelphia, Pa.	" "	1887
William S. Turner, New York, N. Y.	" "	1888
C. Reginald Van Trump, Wilmington, Del.	" "	1894

ASSOCIATES.

Samuel Insull	Chicago, Ill.
A. R. Ledoux	New York, N. Y.

1887.

Thomas Ahearn, Ottawa, Ont.	Transferred in	1887
Charles Batchelor, New York, N. Y.	" "	1887
James H. Bates, New York, N. Y.	" "	1889
Charles S. Bradley, New York, N. Y.	" "	1887
J. Stanford Brown, New York, N. Y.	" "	1887
C. Herbert Condict, New York, N. Y.	" "	1887
Francis Bacon Crocker, New York, N. Y.	" "	1889
Dr. Louis Duncan, New York, N. Y.	" "	1887
R. N. Dyer, New York, N. Y.	" "	1887
J. Day Flack, West Brighton, N. Y.	" "	1895
Horatio A. Foster, Baltimore, Md.	" "	1887
William J. Hammer, New York, N. Y.	" "	1887
F. Benedict Herzog, New York, N. Y.	" "	1887
Edward E. Higgins, New York, N. Y.	" "	1887
John W. Howell, Harrison, N. J.	" "	1888
Dugald C. Jackson, Madison, Wis.	" "	1890
William J. Jenks, New York, N. Y.	" "	1887
Edward R. Knowles, New York, N. Y.	" "	1887
A. A. Knudson, New York, N. Y.	" "	1888
H. Ward Leonard, Bronxville, N. Y.	" "	1887
John William Lieb, Jr., New York, N. Y.	" "	1887
William Maver, Jr., New York, N. Y.	" "	1891
Edwards L. Nichols, Ithaca, N. Y.	" "	1887
Michael T. O'Dea, Chicago, Ill.	" "	1896
Sidney B. Paine, Boston, Mass.	" "	1887
C. Wellman Parks, U. S. Navy	" "	1888
Joseph F. Porter, Davenport, Ia.	" "	1887
Robert J. Pratt, Honolulu, H. I.	Transferred in	1887
E. Wilbur Rice, Jr., Schenectady, N. Y.	" "	1888
Elias E. Ries, New York, N. Y.	" "	1887
Andrew L. Riker, Bridgeport, Conn.	" "	1895
Albert L. Rohrer, Schenectady, N. Y.	" "	1888
Harris J. Ryan, Stanford University, Cal.	" "	1895
Frank Julian Sprague, New York, N. Y.	" "	1897
William Stanley, Great Barrington, Mass.	" "	1898
Charles A. Terry, New York, N. Y.	" "	1887
Ernst Thurnauer, Paris, France	" "	1887
Francis R. Upton, Orange, N. J.	" "	1892
W. D. Weaver, New York, N. Y.	" "	1887
Edwin R. Weeks, Kansas City, Mo.	" "	1887
A. E. Winchester, South Norwalk, Conn.	" "	1887

ASSOCIATES.

Enos M. Barton	Chicago, Ill.
Paul T. Brady	New York, N. Y.
Charles A. Coffin	New York, N. Y.
Frank E. Fielding	Virginia City, Nev.
H. McL. Harding	New York, N. Y.
Hubert Howson	New York, N. Y.
Dr. H. F. R. Hubrecht	Amsterdam, Holland
C. J. R. Humphreys	New York, N. Y.
Frank E. Idell	New York, N. Y.
William Pierson Judson	Oswego, N. Y.
Richard J. Nunn	Savannah, Ga.
Almon Robinson	Lewiston, Me.
Ferdinand W. Roebling	Trenton, N. J.
Lemuel W. Serrell	Plainfield, N. J.
Charles F. Sise	Montreal, Can.
George H. Stockbridge	New York, N. Y.
Francis R. Welles	Paris, France
Henry M. Whitney	Boston, Mass.
Edmund L. Zalinski	New York, N. Y.

1888.

Edw. G. Acheson, Niagara Falls, N. Y.	Transferred in	1888
Eugene H. Chubbuck, La Salle, Ill.	" "	1899
Samuel S. Dickenson, New York, N. Y.	" "	1889
Ludwig Gutmann, St. Louis, Mo.	" "	1893
Carl Hering, Philadelphia, Pa.	" "	1888
John D. Ihdler, New York, N. Y.	" "	1903
Arthur E. Kennelly, Cambridge, Mass.	" "	1899
Philip A. Lange, Manchester, Eng.	" "	1888
John Langton, New York, N. Y.	" "	1888
William Dennis Mars, New York, N. Y.	" "	1888
Horace F. Parshall, London, Eng.	" "	1890
Cecil P. Poole, New York, N. Y.	" "	1902
Frederick Reckenzaun, New York, N. Y.	" "	1888
Sir David L. Salomons, London, Eng.	" "	1888
Montgomery Waddell, New York, N. Y.	" "	1888
Leonard Waldo, New York, N. Y.	" "	1888
Charles J. Wharton, London, Eng.	" "	1888
Fremont Wilson, New York, N. Y.	" "	1888
Townsend Wolcott, New York, N. Y.	" "	1890

ASSOCIATES.

Henry W. Blake	New York, N. Y.
Willard E. Case	Auburn, N. Y.
Charles J. Goldmark	New York, N. Y.
Frederick Saxelby	East Orange, N. J.
Lewis Searing	Denver, Col.
Nikola Tesla	Wardenclyffe, N. Y.
Henry C. Townsend	New York, N. Y.
William H. Wiley	New York, N. Y.

Use of the Telephone for Train Dispatching.

In a paper read before the St. Louis Railway Club, on Feb. 12, Mr. W. E. Harkness pointed out the progress made in the past year in the use of the telephone in place of the telegraph for the directing of train movements and the dispatching of trains on steam railroads. The author stated that, in comparison with the present practice of dispatching trains by telegraph, there are the following differences and advantages:

The orders are issued verbally by the dispatcher to the operator or operators over a metallic circuit telephone line in place of being sent by telegraphy. By means of selective apparatus each station is called individually without signaling the other stations on the line. It has been found that the operators answer the selector bell more promptly than they do the sounder, due partially to the extra volume of sound given by the bell and also to the fact that it will ring until the call is answered.

The accuracy of the telephonic transmission is clearly shown by the fact that the dispatching and reporting of trains on a large number of roads have been handled for a year or more by telephone without mistakes having occurred.

Telephones are now used for train service over certain sections by the Lake Erie Alliance & Wheeling, the Pennsylvania, the New York Central & Hudson River, the Chicago, Burlington & Quincy, the Lake Shore & Michigan Southern, the Chicago & Northwestern, the Michigan Central, the Chicago, Milwaukee

& St. Paul, the Northern Pacific, the Delaware, Lackawanna & Western, the Great Northern, the Chicago, Rock Island & Pacific, the Union Pacific, the Illinois Central, the Canadian Pacific, the Atchison, Topeka & Santa Fé, the Erie, the West Jersey & Seashore and the Virginia Railroads.

Meeting of Boston A. I. E. E. Section.

The regular monthly meeting of the Boston section of the American Institute of Electrical Engineers was held at the Edison Building, Boston, on Feb. 17. Prof. Elihu Thomson reviewed his recent paper read before the New York section on "Conditions Affecting Stability in Electric Lighting Circuits."

ARC LIGHT DYNAMOS.

An extended discussion on arc light dynamos was held at the conclusion of the paper. Mr. C. M. Green, of the General Electric Company, Lynn, Mass., pointed out that on every arc machine there is a large number of turns on the armature, with relatively long pole pieces, which introduce large armature reactions and a tendency to buck back the field. In the Brush, Excelsior and the Schuyler arc machines the final regulation was secured by shunting the current from the field. The following table illustrates the improvement which has been made in the design of Brush arc dynamos:

No. of Machine	7½	12	13
Volts	2500	8300	15000
Amperes	9.6	6.6	4.
Commutator section	3	4	4.
Volts per section	833	2125	3750
Rise of temp. pole shoe, deg. C.	270	11	30
Material		Cast Iron	
Bonds on fields	Yes	No	No
Lbs. copper per kw	54	29.5	26.2
Efficiency	70	88	85

The use of laminated pole pieces and highly saturated iron was most effectual in tending to reduce the temperature rise.

Mr. Green pointed out that there has been a marked change in the design of Brush machines. In the early machines the clearance between the armature teeth and pole faces was about 3/16 in., and the pole faces were not beveled. Excessively heavy eddy currents resulted, and if one of these machines ran for any length of time the japan was burned off the pole pieces. A bobbin can be short-circuited under full-load conditions or under ordinary working conditions and the machine will operate all night without the bobbin burning out, on account of its inductance. If a few turns are short-circuited, however, the bobbin will burn out. In the later machine the thickness of the pole shoe has been reduced from 50 per cent to 70 per cent. In addition the pole faces are beveled and on the four-pole machines the pole shoes are external, so that the flux is better distributed, giving a much less peaked wave. In the old bipolar machines there was practically little or no e.m.f. generated in the bobbins during the time in which they were in parallel, and that has been increased many times in the new designs. A few years ago the company had trouble with the Brush machines on account of flashing. The difficulty was overcome by removing 360 lb. of copper in the field, and changing the pole shoes from steel castings to cast iron. This increased the output from 8000 volts to 8500 volts. On the later machines the copper was reduced about 25 per cent all told, or 636 lb.

Practically all the four-pole Brush machines had a peculiar habit of breaking down at about 1000 volts alternating current, and yet they ran satisfactorily when not tried with alternating current. The current jumped from the armature bobbin over to the pole face. At Worcester trouble was experienced with the machine flashing. The reason appeared to be that the weather and belt were dry, and that static electricity would accumulate on the frame and then jump to the armature bobbin, which caused a flash-over. The engineers put a higher resistance between the frame and the ground, and in certain other cases where the belts were troublesome, the static could be reduced by mixing up graphite with belt grease and putting it on the belt. The usefulness of the latter did not appear to be in the least impaired. Mr. Green then discussed the use of multi-circuits in Brush arc dynamos and emphasized the advantages of reducing potential strains.

MERCURY-ARC RECTIFIERS.

In discussing the causes of instability of mercury-arc rectifiers Mr. Green said it is necessary to get considerable impedance between the primary and secondary coils of the transformer in order that the apparatus may run steadily. Under normal conditions of operation the transformer from one anode to the other terminal requires practically no voltage. Under certain conditions, however, gases are given out which pocket around the anode and require about 500 volts to start the arc. As a result the lamps begin to pump. It has also been found that if the load on the rectifier tubes is increased, the temperature range over which the tubes will operate becomes considerably narrowed, and this is the main reason why the change has been made from water to oil. Tubes have run over 4000 hours in oil. Another difficulty is that sometimes rectifier tubes deteriorate. As they are shut down gases are absorbed by the anodes and it is a peculiarity of the mercury-arc lamp that the anodes run hotter when the temperature of the tube is lower. As a result, the gases are quickly driven out and a high voltage is required to get the arc to transfer. In fact, sometimes the circuit is opened and a discharge produced requiring about 25,000 volts or 30,000 volts on a 50-light machine as shown by needle points; when the tubes are submerged in oil this discharge cannot very well occur. Lightning arresters were therefore put in with good success.

The John W. Mackay Junior Fellowships.

In July, 1906, Mr. Clarence W. Mackay, jointly with his mother, Mrs. John W. Mackay, gave to the University of California $100,000 for the endowment of the John W. Mackay Junior Professorship of Electrical Engineering, with the proviso that such part of the income as the regents of the university might determine, or the whole, was to be used for the salary of the incumbent of the chair, and that the residue of the income was to be devoted to the furtherance of research work in electrical engineering in the university.

In accordance with the terms of this endowment, the University of California has established two John W. Mackay Junior Fellowships in Electrical Engineering, of an annual value of $600 each. The tuition charges of the university are nominal. These fellowships are open to all properly qualified university graduates. The object of the fellowships is not to facilitate ordinary engineering or scientific study, but to enable students who have completed a college course to do research work in electrical engineering, with a view to aiding the advance of the application of electricity to scientific and industrial purposes.

The place of residence of those holding the fellowships is to be at the University of California. Experimental or other work, however, may be carried on outside the laboratories of the university. The appointment to each fellowship is to be for one year, which appointment may, however, be renewed, at the discretion of the graduate council of the university. Applications for the fellowships should be filed with the university as early as March 15 if possible.

Wireless Telephone as Fog Signal.

A patent was issued on Feb. 23 to Mr. R. H. Marriott for a scheme for determining the distance between a ship and shore station on another ship. The inventor employs wireless telegraph apparatus as one of two simultaneous means of transmitting sound to the ship from the distant point, the other means involving the water itself. By the use of a bell arranged for submarine signaling there is produced a sound that is transmitted practically instantly to the ship receiver by wireless telephony, and also at comparatively slow speed by way of the water to a separate receiver used by the same listener. The time interval between the receptions of the two signals depends upon, and is used as, a measure of the distance between the bell and the listener.

Relation of Load Factor to Power Costs.

The Chicago branch of the A. I. E. E. and the electrical section of the Western Society of Engineers held a joint meeting at Chicago March 2 to listen to three papers on "The Relation of Load Factor to Power Costs."

Mr. C. A. S. Howlett, the author of one of the papers, was not able to be present, and on account of sickness had not been able to prepare the comprehensive paper he had hoped. He briefly called attention to the early history of the Wright demand system of charging in Boston and to the fact that the policy of the company which had adopted this system had proved the most successful in the long run. He also emphasized the importance to the consumer and to the company of selecting motors which were not too large for the work to be done, thus keeping down the first cost of the installation and the cost of operation. There is a very strong tendency to purchase motors too large for a given piece of work.

Mr. J. M. S. Waring's paper pointed out how the application of the storage battery enabled a large power purchaser to secure better rates. A power rate, he said, in order to be equitable must first distribute the fixed charges on the plant in proper proportion among the various customers, so that each customer pays fixed charges on the capacity of plant required to serve him. The rate must, second, distribute the operating expenses or variable charges in proper proportion among the customers. Any rate to be equitable must have, therefore, a primary fixed charge and a variable operating charge. The large consumer of power may reduce the primary or fixed charges which are proportionate to the maximum demand which he makes upon the power-supplying company by installing storage batteries to take care of the peak of his load. He can thus purchase power at a lower rate.

Mr. E. W. Lloyd, contract agent for the Commonwealth Edison Company, of Chicago, gave some interesting figures taken from the records of a large number of consumers on his company's system. He said that it is becoming generally recognized that a consumer's load factor should determine his rate. In order to determine the load factor an instrument for measuring the maximum demand is necessary. At the present time maximum-demand meters which are satisfactory for indicating maximum direct-current power are obtainable. For alternating-current power circuits, however, no instrument of reasonable cost has yet been put on the market. As a substitute for a maximum-demand instrument, the Commonwealth Edison Company's practice had been to assume that the consumer's maximum demand was a certain percentage of his connected load in horse-power. These percentages were first determined about two years ago by figures from several thousand direct-current motor installations connected to the company's lines. These motors were all provided with Wright maximum-demand meters so that the ratio of the connected horse-power to the actual maximum demand could be determined. The percentages have since been checked with records of about 4000 more customers. The company figures the maximum demand of alternating-current power customers by taking 746 watts per horse-power of motor and multiplying this by the following percentages:

	Per cent
Installations under 10 hp, only one motor used	85
" under 10 hp, more than one motor used	75
" from 10 hp to 50 hp, irrespective of number of motors	65
" over 50 hp, irrespective of number of motors	55

At one time it was thought by some that a central station could not safely connect a load equal to more than the rated capacity of its plant. Experience has proved that, owing to the diverse character of load and the different hours of maximum demand, the connected load may be two or three times the station capacity.

In opening the discussion on this subject, Mr. W. L. Abbott, chairman, briefly reviewed the history of rate-making. The flat rate of so much per lamp per month had some obvious objections from the companies which paid the coal bills. The next plan proposed was a uniform rate per kw-hour for all electricity used without regard to when or how it was used. Since then the constant problem has been how to combine these two methods of charging so as to make a rate equitable to various consumers.

Mr. John F. Gilchrist pointed out that, logically, power should be charged for according to the peaks upon the generating plant caused by the various consumers, rather than by the individual peaks of different consumers which might occur at other times than during the peak of the station load. As this seems to be impracticable, most companies have schedules of rates based on the individual peaks and load factors of the various consumers. This is somewhat unfair, because it assumes that all consumers use their maximum demand at the time of the station's evening peak, whereas, as a matter of fact, the maximum demand of some consumers may be at 9 o'clock in the morning or at any other light-load period of the day. But this seems the only feasible way at present. He called attention to the increasing diversity of load on a large central-station system which gradually adds different classes of customers. These customers have peaks which come at different hours of the day and make it possible for the central station to handle the load more economically than would be possible with less diversity of business. For example, in a large residence district, the maximum load of any individual consumer would probably last but a short time each evening under ordinary circumstances. The maximum of various consumers, however, does not correspond, and the result is that the peak lasts four or five hours on a feeder supplying such a large residence district. There is also a nice diversity of load between power and residence business, as power business closes down at the end of the business day at the time that the residence load is coming on. In the case of a central station which also supplies street railways, the railway peak of the year is likely to occur in January or February. On account of the use of electric heaters, this peak is also related to the temperature, which is usually lowest in January or February. In case steam railroads should electrically equip their terminals, the peak load for that business would probably be in October, when the grain crops are being brought in.

The method of determining the peaks of railway loads upon which to base the fixed charges per kilowatt of maximum demand may have an important influence on the amount of such fixed charges. For example, the method of determining the maximum demand made by street railways in Chicago, as stipulated in a recent contract (see *Electrical World*, Oct. 31, 1908, page 934), is by taking the combined output of six hours, three of which shall be the hours of greatest output in the first half of the day for three consecutive days, and the other three the hours of greatest output for three consecutive days in the second half of the day. These six hours of output divided by six determine the maximum demand for the year. If momentary peaks were the basis of measurement, the Chicago railways would have to pay for about 15 per cent greater maximum demand. The yearly load factor of Chicago street railways Mr. Gilchrist stated to be from 38 to 40 per cent.

Mr. P. Junkersfeld brought up the point that a consumer should not only be charged with the fixed charges on the apparatus actually needed to serve him, but also on the apparatus kept in reserve. In a large city this reserve or insurance feature is very important as reliability of service is worth much.

Mr. G. H. Atkin said that the storage battery installed in the Plymouth Place substation by the Chicago City Railway Company reduces the maximum demand made by that company 2500 kw below what it would be if the battery were not present. This means a saving to the railway company in the purchase of power from the Commonwealth Edison Company of $37,500 per year.

Mr. J, L. Hecht said that the station characteristics as well as the load factor influence the cost of production. These station characteristics depend on the number and size of the boilers and the number and size of the generating units. For example, a station operating with one unit would show an increased economy with increased load up to the point where another unit would have to be started. This would cause a reduction in

fuel economy, but might call for increased labor; increasing load on the station after the second unit was started would reduce the cost per kilowatt, and so on. He gave figures from one station in which the output was increased from 600,000 to 800,000 kw-hours per month, with a decrease of 14 per cent in the cost of fuel and 32 per cent in the cost of labor per kw-hour. In this particular case the load factor had decreased with the increased output on account of a greater proportionate increase in peak. In another station the output increased from 220,000 to 430,000 kw-hours, the load factor also increasing, and there was a decrease of 35 per cent in kw-hour fuel cost and 34 per cent in labor.

Mr. S. M. Bushnell spoke of expenses connected with the operation of small isolated plants. He gave as typical figures covering fairly average conditions in isolated plants in Chicago fixed charges amounting to 50 per cent and operating charges amounting to 50 per cent of the total cost. Of this operating charge, about half would be coal, making the coal cost about 25 per cent of the total actual cost.

Mr. E. W. Lloyd, in closing the discussion, said that in smaller towns where consumers could be watched, it is practicable to make non-peak contracts with consumers at lower rates in consideration of these consumers shutting down during the central-station peak-load period. This would not be practicable in the city. On the other hand, the diversity of load on a large city system helps to reduce the fixed charges connected with serving a customer.

Massachusetts Underground Wire Legislation.

A hearing was given at Boston on Feb. 24 by the committee on mercantile affairs of the Massachusetts Legislature in connection with the bill accompanying the petition of Mr. John C. Hadlock to require all public service corporations using the streets to place their wires underground by 1915. The bill is considered by those affected to be one of the worst measures which has been brought before the Legislature in recent years in relation to electric service companies, and after the case had been argued against the companies by Mr. Hadlock, with little apparent impression on the committee, several representatives of the lighting, railway and telephone interests in the State registered their earnest opposition to the proposed law.

Mr. Arthur L. Spring, of the Law Department of the city of Boston, opposed the bill on account of its interference with the underground wire act which is now being followed by the companies in Boston. For the Massachusetts Electric Lighting Association, representing prominent central stations throughout the State, Mr. Everett W. Burdett opposed the bill on the grounds that wires are being buried as rapidly as the companies can bear the cost. Mr. Burdett called attention to the act as destructive of the business of the companies, saying that if it were passed there would be no electrical service financially possible except in the most congested centers. He understood informally that the cost of placing the wires of the Boston Elevated Railway Company alone, under ground, would be $12,000,000, which is more than the cost of the new Washington Street tunnel complete.

Mr. Edward H. Hall opposed the bill in behalf of the New England Telephone & Telegraph Company, pointing out that it is a thoroughly pernicious measure. The company already has over 66 per cent of its wires underground in Massachusetts. If it were required to put the balance underground in the time stated by the bill the cost would be anywhere from $15,000,000 to $25,000,000, and the expenditure of such a sum for such a purpose might drive the company utterly out of business. For the Postal Telegraph Cable Company Mr. G. P. Wardner urged that the bill would be unconstitutional. The United States laws give telegraph companies the right to locate their pole lines in the highways so long as they do not obstruct the streets. It would be impossible in the first place to operate satisfactorily a system buried underground in this way, and it would cost at least $7,000 per mile to bury the circuits, which would be entirely prohibitive. The last remonstrant was Mr. A. H. Brooks, for the Cambridge Electric Light Company. He stated that in the past year his company had expended $200,000 in underground construction. Many other of the larger companies are doing their best to place wires underground in congested centers, notably Worcester. The cost is very great, however, and lines cannot be promiscuously placed underground without hazarding the financial success of the companies.

Wireless on a Railroad Train.

By F. M. Sammis.

Doubtless readers of the *Electrical World* have seen in the daily press accounts of the experimental equipment of a New York Central train with wireless telegraph apparatus. However,

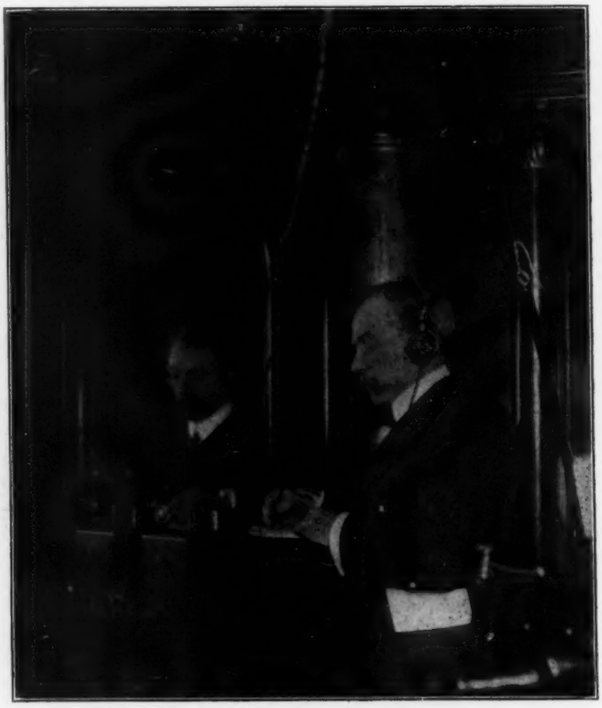


FIG. 1.—WIRELESS STATION ON PULLMAN PARLOR CAR.

a brief description of just what was accomplished and how it was done may be of interest.

As the technical head of the Marconi Wireless Telegraph Company of America, the writer has long since ceased to exhibit surprise at even apparently the wildest proposal for some new use for this means of communication. The use of wire on airships and submarine boats, and for polar expeditions, automobile and yacht races is more or less common, but when that master of ingenuity, Mr. Frederic Thompson, wishes to know whether a 10-car Pullman train can be equipped to do satisfactory work, one feels inclined to spar for time. However, after a few minutes' discussion, it was agreed to undertake the work.

Mr. Thompson had arranged with the New York Central for a 10-car special train to leave Buffalo at 9:30 a.m. on Feb. 27 and carry his "Via Wireless" and "Polly of the Circus" companies to Chicago. Since it was impossible to assemble this train before 7 a. m., but two and a half hours remained in which to make the installation. This was accomplished, however, with some time to spare.

The antenna was of necessity the horizontal type, since the overhead clearance for bridges was but 6 in. Each car was fitted with vertical iron-pipe supports, and between these and over the car roof a stranded copper wire was stretched, having hard-rubber strain insulators inserted at each end, the 10 cars being coupled together with slack-connecting wires to allow for curves.

In the center of the train was placed a buffet parlor car, and here, in the barber shop, was located the Marconi station, the

barber's chair serving as an instrument table. Two leading-in insulators were poked through a ventilator and a lead brought in from that portion of the antenna extending to the rear, and a second lead from the forward extension in like manner, thus forming two unidirectional aerials working in opposite directions. A ground connection was then made by carrying a lead through the window and securing it to one of the main journal boxes.

Four Marconi operators had been despatched a day previous to Cleveland, Toledo, Elkhart and Chicago, each with a set of apparatus and instructions to rig up the best station possible. The "Via Wireless Special" with two big express engines speeding westward, often at the rate of 70 miles an hour, was able to communicate with these stations over a distance of 60 to 80 miles. The rear section of the antenna was used until the

FIG. 2.—HORIZONTAL ANTENNA ON TOP OF CAR.

station was reached, after which the forward section was switched in.

While there was a heavy snowstorm raging and some insulation difficulties were experienced, due to coating of the insulators with soft-coal smudge, the experiment was successful to a degree, good communication being maintained with each of the stations.

Among those who made the trip at the invitation of Mr. Thompson, and who were enthusiastic at the results obtained, were Messrs. L. W. Landman, general Western manager of the Lake Shore Railroad; C. W. Chevee, general Eastern passenger agent of the Lake Shore; Harry Parry, general agent of the New York Central at Buffalo; L. W. Cooke, superintendent of the Lake Shore at Buffalo.

Report Against Municipal Lighting at Clinton, Mass.

The committee appointed by the town of Clinton, Mass., to investigate and advise with reference to the purchase and operation of the local lighting plant has reported unanimously that such a plan is at present financially impractical. The consulting engineer of the committee was Mr. James H. Vail, of New York City, who made a special report on the whole lighting situation, advising against municipal ownership, after a study of the conditions.

The present central-station and gas business is handled by the Clinton Gas Light Company. In 1904 the capital stock of the company was $50,000. In 1908 it was $123,000, with funded indebtedness of $110,000 and a floating indebtedness of $46,060. The gross receipts for 1908 were $28,956 for gas and $34,142 for electricity, or a total business of $63,098. The reports show that the business has not been operated with large financial success in proportion to the stated investment of the company. Mr. Vail called attention to the fact that if the town should purchase the property material economies would have to be applied to secure better results and new money must be expended to improve the equipment and obtain a higher degre of economic administration.

The present electric plant and system are, from an economic point of view, very inefficient as compared with a modern type of apparatus. On account of this condition it is evident that before long it will be uneconomical to continue operations with the present equipment. New constructions and extensions must be financed from year to year; new business must be canvassed and all the new money expended should earn twice the interest charges or its expenditure is not justified. The business must be strenuously developed to the end of increasing the gross receipts. Expenses do not increase in the same ratio as new business. Furthermore, the management placed in charge of the plants requires to be highly efficient and skilled in the work of operation, with the object of attaining from year to year a proportionate reduction in the cost of operation. The field for new business in the town is large and should be developed by more liberal illumination, greater inducements to use electric motors and an increase in the use of gas stoves.

The book values of the plant are totaled up to $142,610, and the replacement value, based upon the estimated cost to duplicate the plant and system, is $102,805. The estimated value based on the usefulness of the plant and operating system, deducting a conservative amount for depreciation, is $89,545. A saving of perhaps 15 per cent in operating expenses would accrue from the close physical association of the electric and the gas plants of the company. The gas system operates at 93 per cent of its gross earnings, is not profitable, and the net income is barely 2 per cent upon the valuation. In the electric system, with gross receipts of $34,142, operating expenses of $24,582, and a net revenue of $9,560, the ratio of operating expenses to gross earnings is 72 per cent. The net revenue for both systems is $11,638. If the entire plant and system were sold to the town at the company's price of approximately $460,000, the bond interest at 4 per cent would amount to $18,400 per year, and deducting the net revenue stated above, there would be shown a deficit of $6,762. It is evident, according to these figures, that there would be nothing attractive as a business proposition to the town in this situation. Said Mr. Vail in conclusion:

"I could not advise purchasing the electric and gas plants at the price quoted and I believe that the only way to arrive at an equitable price is to follow the course provided by the laws of Massachusetts."

In the light of this report and its inquiries the committee "is unanimously of the opinion that it would be undesirable and inexpedient for the town to establish municipal lighting at this time."

Brooklyn Edison Educational Course.

The Brooklyn Edison Company has just completed its third and most successful season of educational work under the direction of Prof. Sydney W. Ashe. The added success was due in a large measure to the general spirit of co-operation which prevailed. The scheme of having supplementary talks by Edison officials or department heads in conjunction with the lectures, bringing out both the theoretical and the practical phases of the work, has done much to arouse and maintain interest, cause discussion and stimulate attendance.

The average attendance this year was 60 per cent greater than last year. The course consisted of 20 weekly lectures on the Brooklyn Edison system, extending from the coal pile to the consumer. The general discussion by the men toward the close of each lecture was encouraged to a greater extent than in previous years, which tended to broaden the benefit of this educational work by clearing up many points which were previously vague. An interesting feature of the last lecture was a demonstration by Miss N. Nevin, of the sales department, on the value of electrical household utilities.

CURRENT NEWS AND NOTES.

PHILADELPHIA CITY WIRELESS.—The city of Philadelphia will install a wireless plant on the top of the tower of the City Hall, which is more than 500 ft. above the street level.

UNDER-WATER WIRELESS.—Francis B. De Witt, a student at Stanford University, is reported in the newspapers as having made successful experiments in the transmission of wireless through water.

A. I. E. E. ANNUAL CONVENTION.—The next annual convention of the American Institute of Electrical Engineers will be held during the week beginning June 28, 1909, at Hotel Frontenac, Thousand Islands, Frontenac, N. Y.

FRENCH LETTER-TELEGRAMS.—The French Department of Posts and Telegraphs has published statistics showing that between Dec. 7, 1908, when the service was inaugurated, to Dec. 31, 6657 letter-telegrams were sent averaging 55 words in length.

POWER FROM BAY OF FUNDY TIDES.—An electric power company is seeking authority to construct dams on a number of rivers emptying into the Bay of Fundy in order to take advantage of the power of the high tides for which the Bay is famous.

WASHINGTON STATE PUBLIC UTILITY LAW.—The Washington Legislature has passed a bill giving the Railway Commission jurisdiction over telephone and telegraph companies and power to compel physical connection between long-distance telephone companies.

INDIANA LEGISLATION.—The Indiana Legislature has passed an act requiring all cities of the fifth class to advertise for proposals when light, heat or water franchises are to be granted or contracts made. Another bill recently passed fixes the maximum price of natural gas at 60 cents per 1000 cu. ft.

TEXAS STATE LIGHTING PLANT.—A bill now before the Texas Legislature provides for an appropriation of $250,000 to build and equip at Austin an electric light, power and water works plant to supply the various State buildings. It appears that the bill is a result of dissatisfaction with the present service from the Austin municipal plant.

"TAFT IS PRESIDENT."—As its part of the Chicago celebration of the inauguration of President Taft on March 4, the Chicago Telephone Company caused all its operators to use the salutation "Taft is President!" instead of the familiar "Number, please?" on responding to calls from 11 to 11:05 a. m., corresponding to noon, Washington time.

OHIO INDEPENDENT TELEPHONE ASSOCIATION.—The annual convention of the Ohio Telephone Association will be held at the Hartman Hotel, Columbus, March 18 and 19. The first day will be devoted to the regular business of the body, and on Friday there will be discussions on construction, maintenance, operation and accounting.

SOUTHWESTERN ELECTRICAL CONVENTION.—As indicating the interest in the coming convention at Dallas of the Southwestern Electrical and Gas Association, the acting secretary, Mr. D. G. Fisher, has issued a circular containing letters from a number of prominent members who predict that the occasion will be one of unusual importance. The meeting will be held in May.

STORAGE-BATTERY VEHICLES FOR WASHINGTON CAPITOL SUBWAY.—In order to enable senators to pass quickly from the Senate office-building to the Senate chamber, the former is connected with the Capitol by a subway electric line. Two storage-battery vehicles have been supplied for this service, and on trial last week operated satisfactorily. The vehicles are of 5-hp and a maximum speed of 12 miles per hour.

CHICAGO RAILWAY CONSOLIDATION AGAIN CONSIDERED.—Since the temporary abandonment of the plans for consolidating the traction lines of Chicago under one management there have been many conferences of business interests attempting to revive the merger scheme. Executive committees of the four elevated roads are now considering plans proposing the formation of a holding company which will lease all the properties for a long time on guaranteed dividends.

FEDERAL FOREST BILL.—As passed by Congress the bill providing for reforestration permits the acquirement of lands in any part of the United States where such acquisition can be shown to be advisable by the National Forest Reservation Commission created by it, after the Geological Survey has determined that such acquisition will promote or protect the navigability of streams on whose watershed the lands lie. Originally the bill was designed to cover the Appalachian and White Mountain ranges, but the House substitute makes its provisions applicable to all States.

THIRTY-THOUSAND-DOLLAR THEFT OF INCANDESCENT LAMPS.—Through the manipulations of several of its lamp clerks, aided by outsiders, the New York Edison Company has been victimized the past two years to the extent of $30,000 or more by the theft of incandescent lamps. Three lamp clerks and a clerk of one of the large express companies are among those implicated. The scheme consisted in sending packages of lamps to an express office, where the express clerk implicated delivered them to an accomplice, driving a wagon identical with those used by the express company.

DEPARTMENT STORE ELECTRICAL SHOW.—As a sort of aftermath of the big Chicago Electrical Show at the Coliseum, one of the large department stores in Chicago is this year, as it did last year, holding a little electrical exhibition of its own. There are a number of exhibits, and the arrangement of booths and lighting effects is something like that of the Coliseum. The Commonwealth Edison Company demonstrates electric cooking and gives away cakes and other products of the electric ovens and other cooking utensils. The Chicago Telephone Company has a six-position multiple switchboard in operation, and there are exhibits of electric washing machines, potato peelers, curling irons, vibrators, batteries, medical sets, lighting fixtures, lamps, shades, etc. An automatic "military band" instrument operated by belted motor furnishes the music, which is certainly most abundant in quantity, if not expressing all the finer gradations of the art in quality. The show began on March 1 and will be continued until March 13.

WHAT CONSTITUTES A BUSINESS TELEPHONE?—As to what constitutes a business telephone or what distinguishes a business telephone from a residence telephone is an interesting and important question to be tested by the court in Elkhart, Ind. The test case grew out of a demand made by the Home Telephone Company that a doctor, paying $2.50 a month, or the business rate, for a telephone in his residence over which he "talks business" professionally. The medical man insists, however, that a telephone in a residence is, under the company's franchise, a "residence telephone" and that no more than $1.50 a month can be legally collected. The telephone having been removed, the doctor asked the court for a temporary order compelling the telephone company to reinstall the telephone until the question can be determined, and the court ordered that the telephone be reinstalled. The question will be considered on its merits in the Superior Court and considerable evidence will be introduced with a view of determining what uses distinguish a business telephone from a residence telephone.

Main and Auxiliary Steam Equipment in Waterside Station No. 2 of the New York Edison Company.

AS stated in last week's issue, the steam generating plant of Waterside Station No. 2 of the New York Edison Company is composed of 96 water-tube boilers, built in batteries of two and each boiler rated at 650 hp. Forced draft is supplied to the boilers by means of 16 independent air ducts running north and south under each line of boilers. Each duct takes care of six boilers and has at each end a blower driven by a Sturtevant engine, the entire forced-draft equipment being supplied by the B. F. Sturtevant Company, of Hyde Park, Mass. Half of the fans are of the Sirocco type and half of the Multivane type. Dampers, one at the center and one at the outlet of each fan, are provided in each duct. In addition each duct has six ash-pit connections to boilers with dampers and means for controlling them from the fireroom floor. The blower engines are of the vertical, double-acting, enclosed type and are rated at 65 hp when operating at 290 r.p.m. under a throttle pressure of 120 lb. saturated steam. The blowers deliver approximately 90,000 cu. ft. of air per minute.

The products of combustion pass off through sheet-iron flues and uptakes for each section into a main uptake connecting with the stack. There are four smokestacks in use, and each takes care of a section of 24 boilers. The stacks are built of ¾-in. to ⅜-in. steel plates, 7 ft. to each course. They are 22½ ft. in diameter at the bottom and 21 ft. in diameter at the top; the top of the stacks is 300 ft. above the lower grates. To every third plate two angles are riveted for supporting the brick lining. This consists of 1 in. of concrete and 4 in. of common red brick clear to the top. Each stack has 6-in. x 4-in. angle stiffening posts riveted to the inside of the shell with horizontal rings. The stacks rest on plate girders and are anchored by 10 1⅞-in. bolts, with wind and sway bracing attached to the framing.

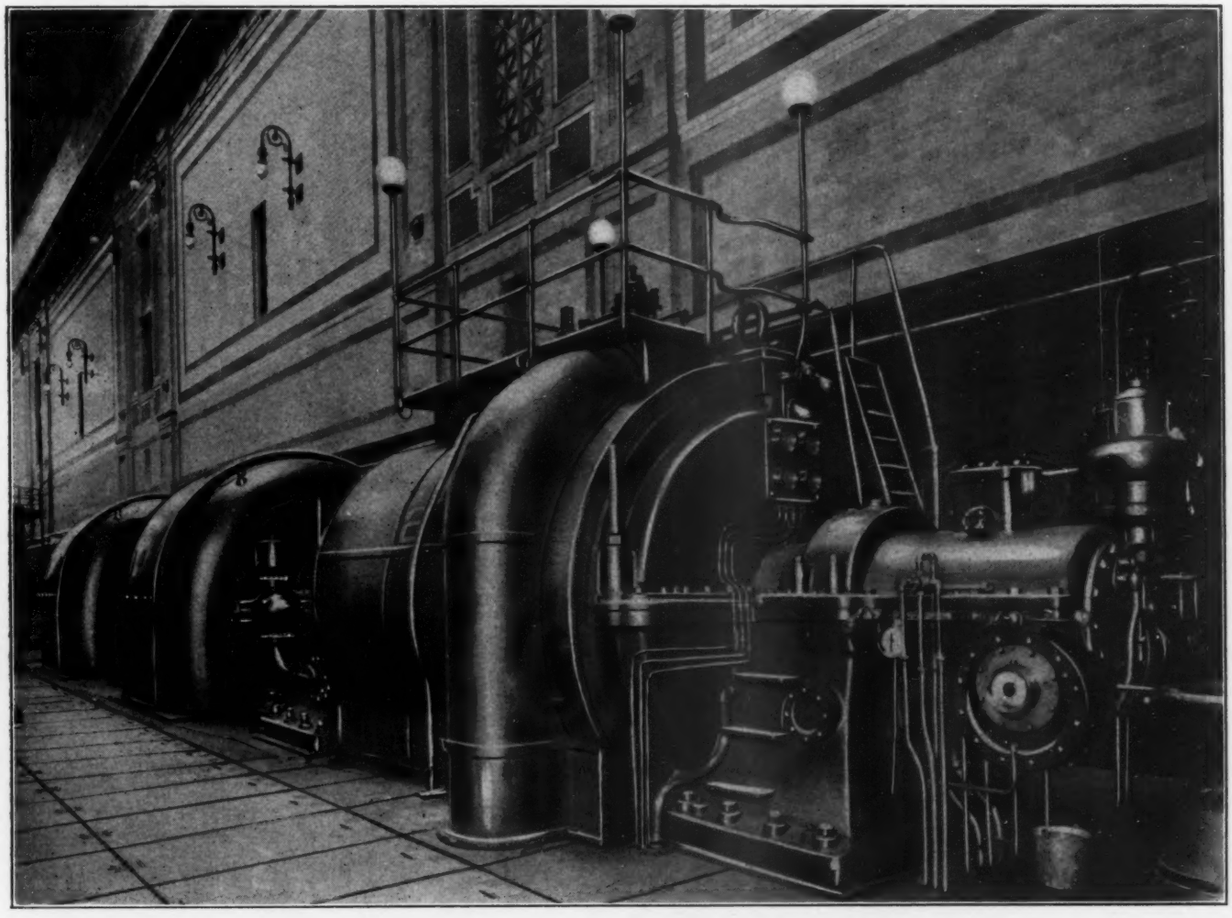


FIG. 1.—VIEW OF ONE OF THE 7500-KW HORIZONTAL TURBINE UNITS.

FEED-WATER SYSTEM.

The feed-water system in use involves a number of interesting features representing what is without doubt the most recent practice in the handling and conservation of the boiler water supply for a large plant. Of chief import is the use of centrifugal boiler-feed pumps and the means adopted for measuring all water delivered and the blow-off wasted. The water for the boilers is taken from the city water mains, the water in the East River being salt and driven wells being impossible in the vicinity of the station. By the use of surface condensers all of the condensation from the large turbines is reclaimed and also practically all of the steam used for the steam-driven auxiliary machinery in the turbine room basement.

The system embraces, in general, a header and connections for the return of condensation from the hot wells of the condensers, large open feed-water heaters utilizing the exhaust from the reciprocating engines and the small turbines, and a system of feed piping with loops surrounding each of the boiler sections. Venturi meters, both indicating and recording, measure all of the feed water delivered. Each of the two pump rooms in the boiler-house basement contains two Platt Iron Works Company open feed-water heaters rated at 500,000 lb. of water per hour and four centrifugal pumps of D'Olier Engineering Company make. The heaters are each 6 ft. x 22 ft. x 11½ ft. high and contain 16 large and 16 small trays arranged in four tiers. Each heater has a total content of about 1000 cu. ft. and the content of the storage chamber is 587 cu. ft.

The hot well returns from the condensers are collected in a 12-in. header located along the north wall of the boiler room. A 14-in. pipe branching to two 10-in. pipes carry the returns into

the tops of the heaters in both pump rooms. The flow is maintained by the hot-well pumps, which are designed to operate against a head of 25 ft. A float operating on a balanced regulating valve controls the amount of water delivered to each heater.

sure with varying quantities of water is maintained automatically by means of a pressure regulator used in conjunction with the fly-ball centrifugal governor mounted on the turbine shaft.

The water is received from the city mains through two 12-in.

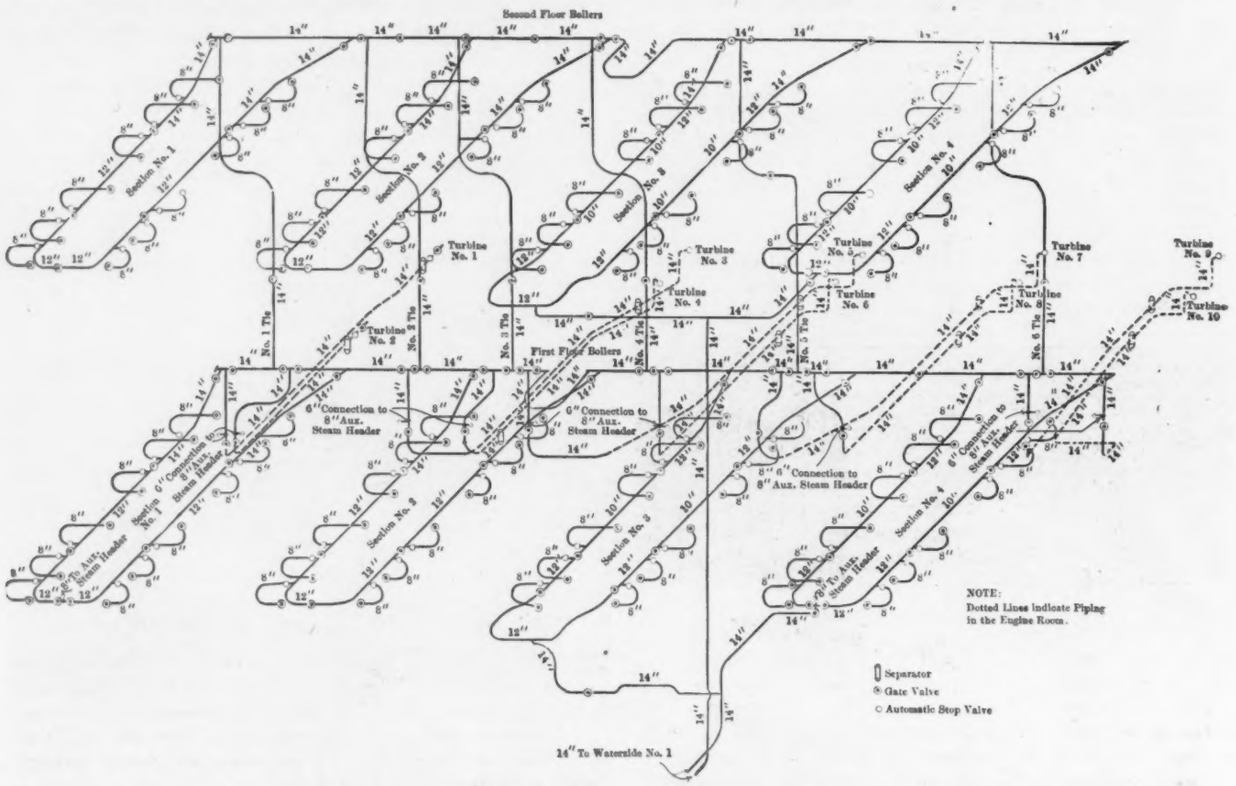


FIG. 2.—ISOMETRIC DIAGRAM OF HIGH-PRESSURE STEAM PIPE CONNECTIONS.

The centrifugal pumps are of the five-stage type with 8-in. suction from a 16-in. suction tie line connecting the bottom of the four heaters. Each pump discharges into 6-in. feed-water ring headers on each tier of boilers through four 8-in. risers. Each set of six boilers is served with a 6-in. tie line between headers and a 3-in. loop, gate valves, angle check valves and 2-in. branch pipes leading into the drums of each boiler. The pumps, which operate at 1650 r.p.m. and deliver 1000 gal. per minute against a head of 700 ft., are connected through flexible couplings to Terry steam turbines rated at 300 hp. The turbines are built by the Terry Steam Turbine Company, of Hartford, Conn.

pipes, one on the First Avenue side of the station and the other on the Thirty-ninth Street side. After passing through a fish trap and check valve the water is metered by four 6-in. meters, the tail water of each being reunited in a 12-in. main and led through 8-in. branch pipes to the heaters. The flow is regulated by a float acting on a two-seat balance regulating valve. A salt-water connection is provided in the pump room in case of interruption in the city water supply.

HIGH-PRESSURE STEAM PIPING.

An isometric diagram of the high-pressure steam piping is shown in Fig. 2. Two main 14-in. headers are located in the

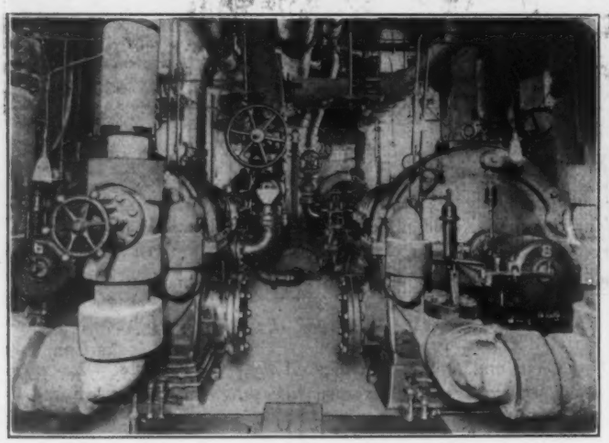


FIG. 3.—TURBINE-DRIVEN CENTRIFUGAL FEED-WATER PUMPS.

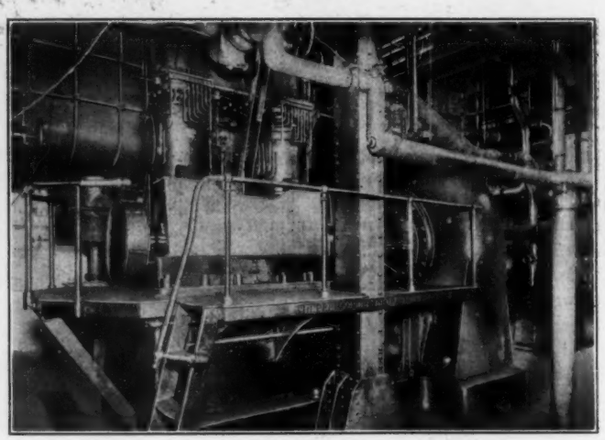


FIG. 4.—CIRCULATING PUMP FOR WHEELER CONDENSER.

They are of the single-wheel type with wheels 3 ft. in diameter and operate under a steam pressure of 175 lb. at the throttle with steam superheated 100 deg. A constant discharge pres-

boiler room below the second and third floors near the division wall. Six 14-in. vertical tie lines connect these main headers at intervals, and valves are arranged so that any section can be

isolated should occasion require it. The turbines are fed with steam from the lower header, the piping passing under the floor of the turbine room, which is 5 ft. above the lower boiler-room floor, and being supported from the steel framework of the operating-room floor. The main ring header is supplied by eight boiler-room headers made up of 10-in., 12-in. and 14-in.

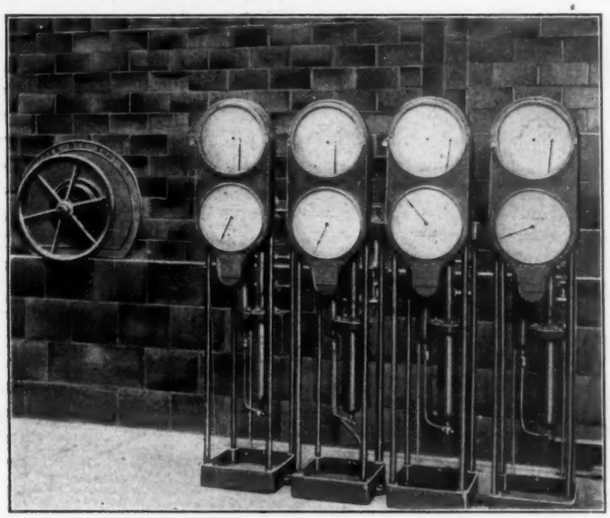


FIG. 5.—RECORDING AND INDICATING WATER METERS.

pipe, four feeding the upper and four the lower header. Besides being separated into sections by valves between each battery of boilers, each boiler-room header forms a loop over one section in each tier. The boiler manifold is connected by means of 8-in. U-bends to the headers. In the bends a combination stop and check valve is located which automatically opens when the pressure of the boiler equals that of the line. The high-pressure steam piping is made up of ⅜-in. open-hearth steel with cast-steel fittings and Whitlock double lap-joints made by the Whitlock Coil Pipe Company, of Hartford, Conn.

Encircling the boiler room above the first tier of boilers is an

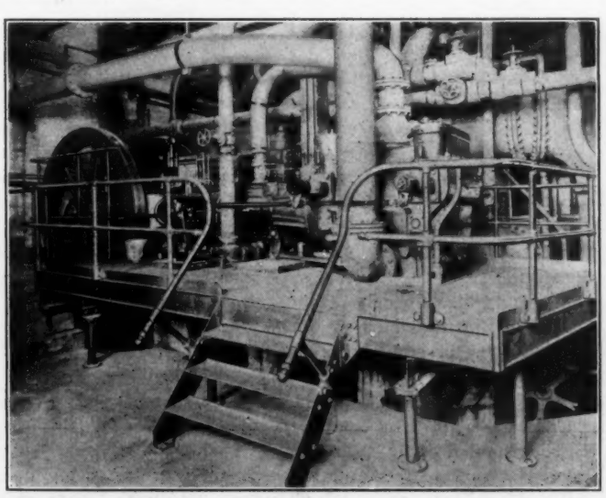


FIG. 6.—DRY VACUUM PUMP FOR CONDENSER.

8-in. ring header which supplies steam to the blower and stoker engines of the first and second tiers and to the pump and compressor rooms in the basement. Each of the auxiliaries in the turbine room basement receives steam through a 6-in. connection to the 14-in. lines supplying the turbines. All of the live-steam lines to the turbines and auxiliary engines are equipped with Cochrane separators inserted near the turbines and engines.

EXHAUST STEAM PIPING.

Along the north division wall of the boiler-house basement is an auxiliary header made up of 8-in., 14-in. and 24-in. pipe leading into an exhaust flue at the east end of the building through relief valves. Branch pipes lead from this header into the pump rooms to supply steam to the feed-water heaters there installed. From the opposite end of the heaters a 12-in. pipe leads to the exhaust flue or stack. All the exhaust lines from the turbine auxiliaries, step-bearing pumps and auxiliary appa-

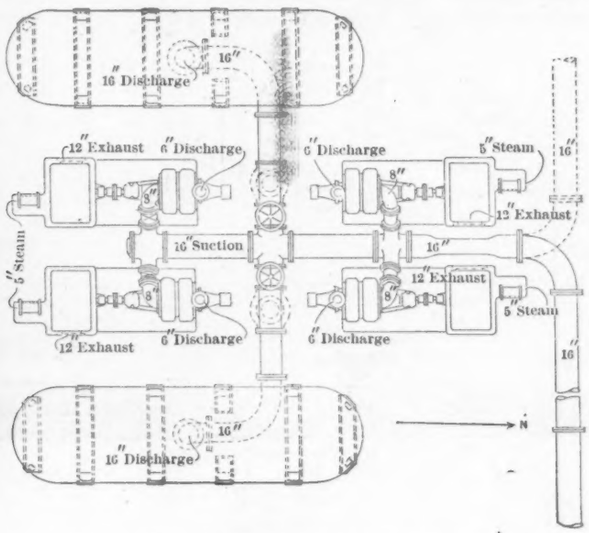


FIG. 7.—PLAN OF FEED-WATER PUMPS AND HEATERS.

ratus in the boiler-house basement connect with the auxiliary exhaust header, and since the auxiliaries in the turbine-room basement are also arranged to operate condensing when the supply of exhaust steam from other sources is sufficient for feed-water purposes, the exhausts from these are passed through Cochrane vacuum oil separators before entering the condensers. Free exhaust for the main turbines is provided by two tunnels described elsewhere in this article. Each turbine is equipped with a 36-in. pipe connection in the exhaust to the turbine and a 6-in. chronometer valve and muffler for breaking the vacuum.

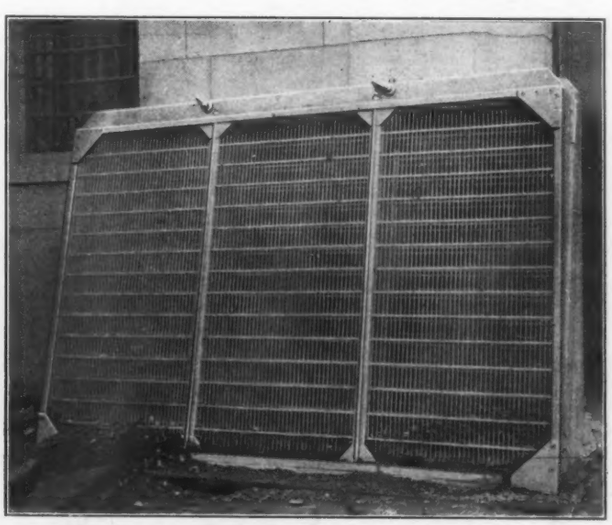


FIG. 8.—SCREENS FOR INTAKE TUNNEL.

The valve and muffler are located near the throttle. The turbines connect with the exhaust tunnels through 36-in. lines.

DRIP PIPING.

The system of high-pressure drip piping at present installed embraces a gravity drip system on all main steam headers located above the water-line of the boilers; a receiver pump drip system on all main and auxiliary lines in the basement of the turbine room and on all high-pressure pipes below the water line of the boilers, and a drip system bleeding the high-pressure

pipes from the coal tower and from the heating system. A low-pressure drip system connected to the cylinders, cocks, etc., of all auxiliaries discharges into the East River.

The elevation of the gravity drip system is above the water line of the boilers, and all of the headers connected to it are drained through a 5-in. return and 2-in. drip-ring header in each section of boilers. Connections are made with the main headers through 1¼-in. pipes forming a vertical loop and water

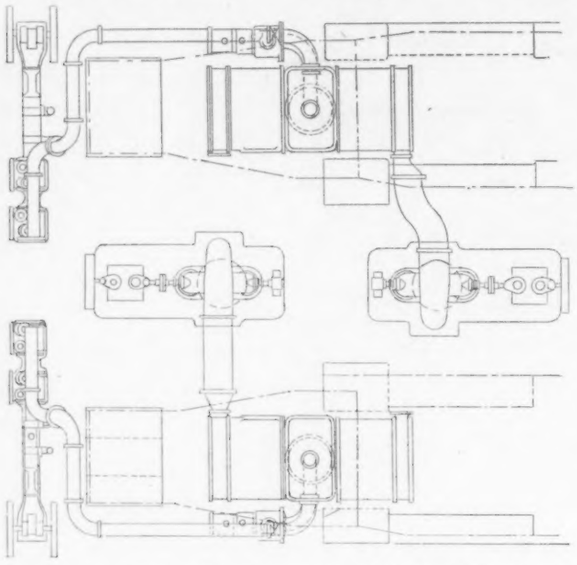


FIG. 9.—ARRANGEMENT OF ALBERGER CONDENSER EQUIPMENT.

leg in order to prevent water-hammer. The water is delivered through gate valves and check valves, entering the mud drums of the boilers. The system of ring headers is tied together with a 3-in. return drip header and by vertical tie lines between the main drip headers in each tier. A complete bleeder system for draining any part of the drip system when repairs are necessary is installed.

The drips from the separators and throttle valves in the main steam pipes to the turbines, as well as the high-pressure drips from the auxiliaries in the basement of the turbine room, find their way into a 4-in. main drip header delivering to automatic receiver pumps located at the base of four of the turbines. These pumps discharge through 2-in. lines into the gravity-drip header of the first tier of boilers. The high-pressure drips from the blower engines and feed pumps, together with the drips from the engine leads, flow through 4-in. pipes to the lower elevation of the main turbine-room drip header. The drip pumps are

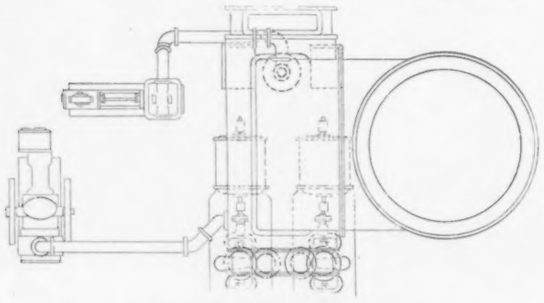


FIG. 10.—ARRANGEMENT OF WHEELER CONDENSER EQUIPMENT.

of the reciprocating type and are started automatically by means of a receiver float.

TURBINES AND CONDENSER EQUIPMENT.

The turbines in the operating room are numbered in regular rotation from the northwest corner, the odd-numbered turbines being along the north wall and the even-numbered turbines along the south wall. Running east and west the turbines are spaced 55 ft. apart, center to center, and running north and south the General Electric units are spaced 28 ft., center to center, and the Westinghouse units 32 ft., center to center. The operating room is 57½ ft. wide and 306 ft. long. A plan view and photograph of this room were given in last week's issue. Turbines No. 1 and No. 2 are of the multiple-expansion, parallel-flow, horizontal type built by the Westinghouse Machine Company. They are rated at 7500 kw when operating at 750 r.p.m. with dry saturated steam at 175-lb. pressure at the throttle and with a pressure in the exhaust pipe of 2 in. of mercury absolute at the exhaust outlet. When operating with steam superheated 100 deg. Fahr. at the above speed, pressure and vacuum, the steam consumption at full load does not exceed 15.9 lb. per kw-hour, at half load 18.3 lb and at 50 per cent overload 17.6 lb. The turbine is provided with a governor of the balanced poppet-valve type enclosed within the valve chest for controlling the admission of steam. In addition there is a quick-operating throttle valve in combination with the auxiliary governor which automatically closes if the turbine speed increases beyond a certain limit.

The Westinghouse units are equipped with Alberger condensing apparatus. The surface condensers are located directly under the turbines to which they are connected by an expansion joint. They are of the three-pass type and have 25,000 sq. ft. of cooling surface. The dry-vacuum pumps are of the single-stage, two air cylinders in tandem type fitted with Corliss valve gear. The wet-vacuum pumps are of the monitor duplex type and the circulating water pumps are of the double-suction centrifugal type direct-connected to two-cylinder vertical engines.

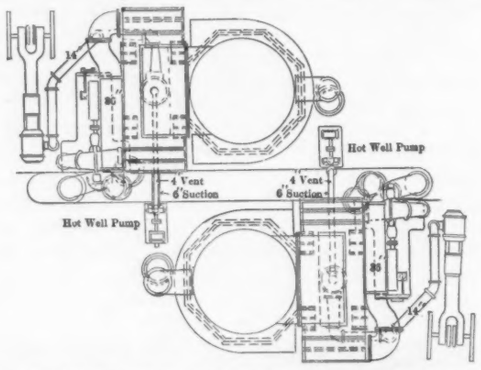


FIG. 11.—ARRANGEMENT OF WORTHINGTON CONDENSER EQUIPMENT.

The arrangement of this condensing outfit is shown in Fig. 9.

All the other main turbines are of the Curtis five-stage type manufactured by the General Electric Company. Turbines Nos. 5, 6, 7 and 9 are rated at 8000 kw and operate at a speed of 750 r.p.m. and are equipped with governors of the hydraulic type. The condensing apparatus for these units was installed by the Wheeler Condenser & Engineering Company. The condensers are of the two-pass, dry-tube type and have a cooling surface of 18,000 sq. ft. They are set to one side of the turbine, as indicated in Fig. 10, which shows the condenser equipment. The circulating water pumps are of the volute centrifugal type direct-connected to double engines. Double-acting steam dry-vacuum pumps are used and the wet-vacuum pumps are of the centrifugal type direct-connected to Terry steam turbines. These are rated at 15 hp and run at 1500 r.p.m. Turbines No. 8 and No. 10 have the same rating as the four just mentioned, but are equipped with Worthington condensing apparatus. Three-pass surface condensers with a cooling surface of 23,000 sq. ft. are used in connection with engine-driven centrifugal circulating-water pumps and horizontal, tandem, rotative dry-vacuum pumps. The wet-vacuum pumps on these turbines are of the two-stage turbine type driven by 20-hp steam turbines built by the Kerr Turbine Company, of Wellsville, N. Y. Turbine No. 3 is rated at 14,000 kw and is equipped with Wheeler condensing apparatus. The condenser has a cooling surface of 18,000 sq. ft. and the circulating-water pumps are driven by Kerr turbines. Two pumps have been installed so that in winter, when the circulating water from the river is quite cold, only

one is kept running; the other serving as reserve. During the summer both pumps are operated. The dry-vacuum and wet-vacuum pumps are driven by reciprocating steam engines. The foundations for turbine No. 4 are now being erected. This unit will be rated at 14,000 kw.

TUNNELS.

For the purpose of taking care of the intake overflow and free exhaust for the large turbines a system of tunnels is installed under the turbine-room basement. Water for condensing purposes is brought into the station from the East River and up to the suction of the circulating pumps through the intake tunnel which extend to within about 22 ft. of the west end of the station. This tunnel has a sectional area of approximately 118 sq. ft. The top of the tunnel is 16 ft. below the basement floor line and circular openings, 4½ ft. in diameter, are provided for the suction pipes of the circulating pumps. The overflow tunnels are located above the intake tunnel and about 6 ft. on either side of the center line of it. Each of the overflow tunnels has an area of about 50 sq. ft., and the overflow pipes from the condensers connect with them through openings provided in the floor. Both of the overflow tunnels unite at the east end of the building into one large tunnel extending out to the river. This tunnel is made with an outer and inner shell, of ¼-in. steel, the shells being securely fastened together by means of lacing bars and the space between them filled with concrete. The tunnel has a section area of approximately 120 sq. ft.

Paralleling the overflow tunnels and outside of each are exhaust tunnels for carrying the steam from the large turbine to the exhaust flue at the southwest corner of the building. Each of these tunnels, of which there are two, has a sectional area of 30 sq. ft., and is lined with cast-iron segments. The five tunnels are constructed in a solid concrete monolith, with separating walls approximately 2 ft. thick. At the east end of the building two electrically driven sump pumps are installed to take care of the seepage into each of the exhaust tunnels, these being below the river. The pumps are of the Watson-Stillman Company make and are direct-connected to 8-hp, 220-volt Westinghouse shunt-wound motors. An automatic starter of the Cutler-Hammer Company make forms part of the motor equipment.

Over the intake tunnel, just outside of the building, a screen well 22 ft. x 12½ ft. x 29 ft. deep is erected with walls of reinforced concrete ranging from 3 ft. thick at the bottom to 2 ft. at the top. The screens consist of heavily galvanized iron gratings, as shown in Fig. 8, with others of finer mesh so arranged as to cover completely the intake tunnel. The gratings are made in four frames and weigh approximately 6000 lb. each. They are removable and are supported on yellow-pine timbers. The finer screens are constructed of ⅛-in. wire, with ½-in. mesh, three screens to the frame. Eight of these frames are arranged in four parallel guides and may be removed by a screen hoist. The latter consists of a 5-hp electric hoist with the necessary tackle. This is placed in a screen-well house of brick and granite similar to the masonry work of the station building.

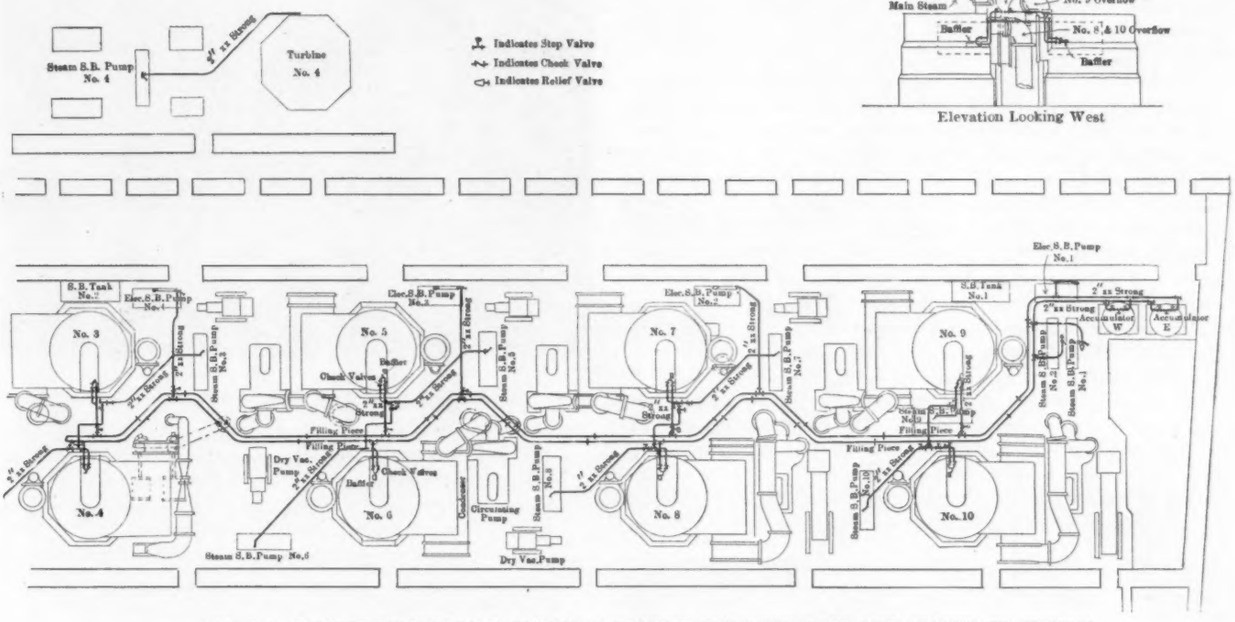


FIG. 12.—PLAN OF TURBINE ROOM BASEMENT SHOWING CONDENSERS AND STEP-BEARING OIL SYSTEM.

OILING SYSTEM.

An elaborate oiling system is installed for supplying lubricant to the various engines, pumps, etc., and also for the step bearings of the vertical turbines. In the sidewalk vault east of the extension to the battery room on the Fortieth Street side is an oil receiving and tank room for engine and cylinder oil. The oil is delivered in barrels through a hatchway and separate steel tanks are provided for each lubricant. Three 2-ft. x 24-ft. tanks are provided for engine oil, and two 2-ft. x 7-ft. tanks for cylinder oil; the total storage capacity in the receiving tanks being over 2000 gal. In the roof house storage is provided for over 12,000 gal. of oil in two 7-ft. x 23-ft. tanks for engine oil and two 2-ft. x 6½-ft. tanks for cylinder oil. In addition the filter tanks have a capacity of 5100 gal. and the step-bearing tanks of 4000 gal.

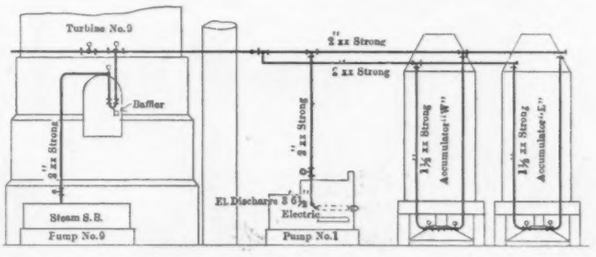


FIG. 13.—STEP-BEARING OIL SYSTEM.

In the filter room, at the west end of the turbine-room basement, are four oil pumps which draw engine oil from the receiving tanks through a 5-in. line. From the filter room the oil is pumped to the tanks on the roof through 5-in. risers connected to the discharge of the pumps. The returns to the oil-

ing system are through 5-in. pipes, also. By this means a positive head of 50 lb. is maintained throughout the system and oil under this pressure is used in the operation of the hydraulic governors of the turbines. By means of cross-connections in the filter room, the roof supply can be cut off and oil pumped directly into the system. Cylinder oil is taken from the receiving room through two 2½-in. pipes and discharged through 2-in. pipes connecting with ring headers distributing cylinder oil throughout the station. The discharge is also connected through 2-in. vertical risers to the tanks in the roof house. Precaution is taken to make the oil vault, roof house and oil shaft strictly fireproof with no direct communication through doors to the station interior.

The turbines receive their supply of oil from two 5-in. pipes leading from the engine-oil tanks overhead and running along the center of the turbine-room basement to a point where taps are taken off to supply the horizontal turbines No. 1 and No. 2. From this point 4-in. mains are continued with branch pipes to supply the vertical bearings and hydraulic governors of the vertical turbines. The blower engines in the boiler-room basement, as well as the feed pumps, are supplied with oil through upper and lower ring headers consisting of two 1½-in. pipes, one for engine oil and the other for cylinder oil. The auxiliaries to the turbines in the turbine-room basement are lubricated from two similar headers. These headers are connected directly to the returns leading from the tanks on the roof.

For the step-bearings of the vertical turbines the oil is maintained under a pressure of 1200 lb. The main bearing area of the step is 168 sq. in. and the system installed for maintaining these steps under pressure is quite extensive. At each turbine is located a steam-driven, step-bearing pump, and variations in the service rendered by these units is compensated for by an

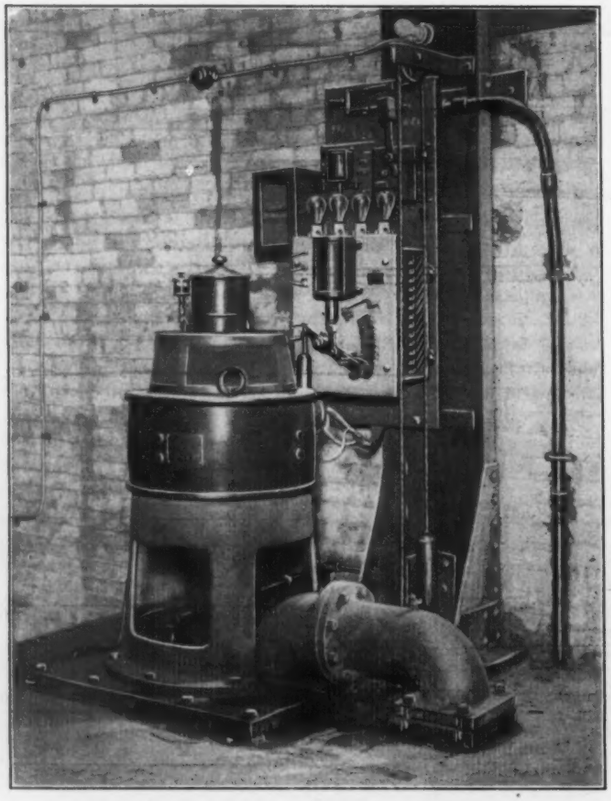


FIG. 14.—SUMP PUMP FOR EXHAUST TUNNEL.

accumulator system. Two 4-in. lines run along the center of the operating-room floor, as shown in Fig. 12, and are connected to the two accumulators located at the east end of the station. Two steam step-bearing pumps operate in conjunction with the accumulators and should these fail four electrically driven, step-bearing pumps automatically come into operation. The suction of all the step-bearing pumps is connected to a 6-in. ring header encircling the turbine-room basement and supplied with oil from two step-bearing tanks. The latter are located near the north division wall and are joined by a 6-in. equalizer pipe. The tanks in the filter room are also connected to this ring header. Each step-bearing receives its supply of

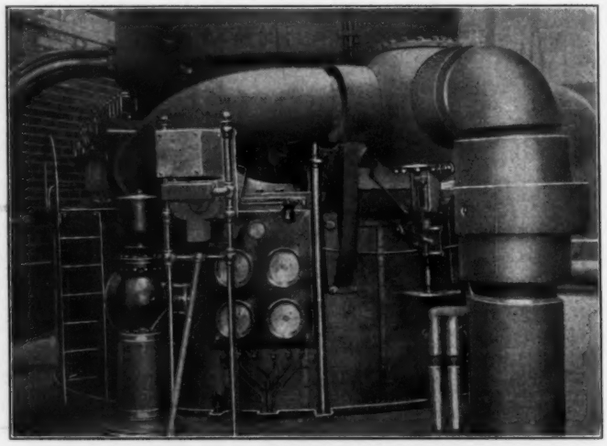


FIG. 15.—STEAM CONNECTIONS TO VERTICAL TURBINE.

oil through a 2-in. pipe, stop valve, check valve and baffler, the pressure inside the latter being maintained at 1000 lb. About 20 gal. of oil per minute is delivered to the step bearings, and the returns are led through 2½-in. pipes to a 6-in. header connecting with both the step-bearing and the filter tanks. In the filter room the oil is strained, dehydrated, cooled and returned to the step bearings.

The circulating water for the oil cooler is pumped by two single-stage centrifugal pumps made by the Lawrence Machine Company and direct-connected to a 15-hp, 200-volt Westinghouse motor. Three of the oil pumps are of the duplex piston type, built by the G. F. Blake Manufacturing Company, and one is a two-stage turbine pump, built by the Jeansville Iron Works Company. The pump is driven by a 25-hp, 220-volt Browning motor. Dirty oil is handled by three duplex piston pumps of Blake manufacture, and the cylinder oil is handled by two pumps of the same type and make.

Eight of the step-bearing pumps are of the Dean Brothers duplex-plunger type and four are of the hydraulic-triplex type built by the Platt Iron Works Company. The latter are all

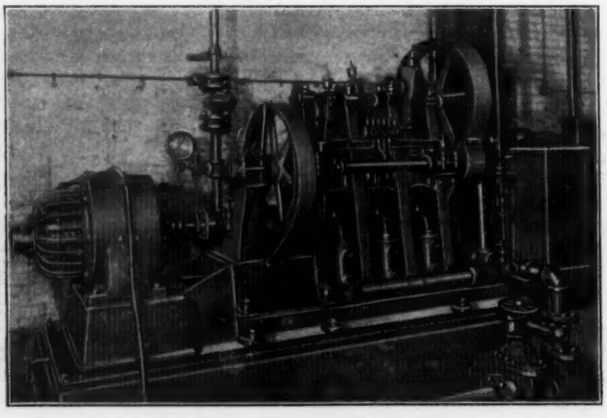


FIG. 16.—ELECTRIC OIL PUMP FOR STEP BEARING SYSTEM.

direct-connected to 15-hp shunt-wound motors of General Electric build, controlled by Ward Leonard starting boxes and General Electric speed regulators. A view of one of the electrically driven oil pumps is shown in Fig. 17.

The electrical equipment and control of the station will be treated at length in a subsequent article.

Electric Lighting at Bahia, Brazil.

By A. H. KELEHER.

MEASURED by the time required to travel by steamer, the city of Bahia, Brazil, is 15 days from New York. Viewed from the standpoint of the electric illuminating engineer, Bahia is a progressive city possessing many places of interest.

The energy for lamps and motors is supplied by two central-station companies, the Bahia Light & Power Company and the Guinle Company. The e.m.f. of supply is a mixture of 110 and 220 volts, with the latter predominating.

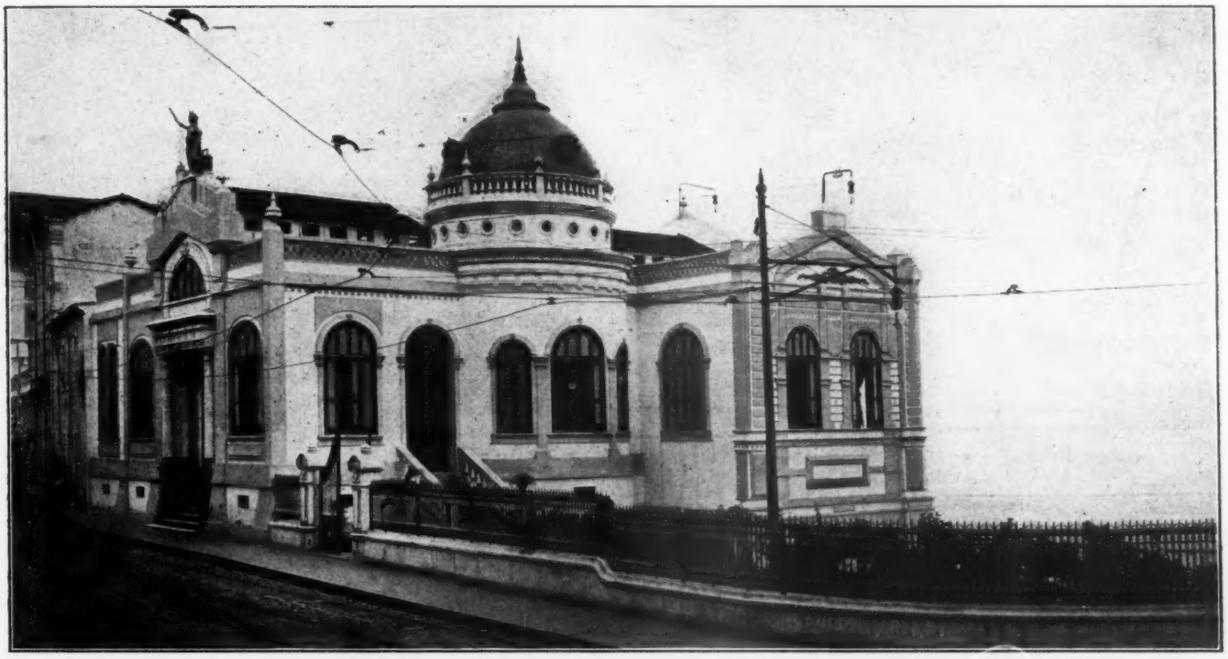


FIG. 1.—EXTERIOR ILLUMINATION OF HEAD OFFICE OF LINHA CIRCULAR COMPANY.

the two important tramway lines owned by the Guinle Company, namely, the Linha Circular, 14 miles long, and the Trilhos Centraes, 19 miles in length.

Three General Electric turbines in the Preguiça power house furnish the energy consumed by the above installation. These turbines are of the latest improved type and each is rated at 1500 kw, 2300 volts. From the power house the electrical energy is transmitted over the three-phase lines of the company to three substations at Graça, Barroquinla and Preguiça. Each of these substations is equipped with two 275-hp, 500-volt rotary converters. In general, American-made machinery predominates in the power house and each of the substations.

FIG. 2.—STREET CARS AND LAMPS IN BAHIA.

Twelve thousand 20-cp incandescent lamps and about 200 hp in motors are connected to the lines of the Guinle Company. Moreover, energy is furnished to many arc lamps, and also to

In the Preguiça power house there is a very modern equipment of Babcock & Wilcox boilers.

The workshops of the Linha Circular use the latest approved

American machinery, such as the makes of the Fay & Egan Company and those of the American Tool Works. This shop, which is located in a large, spacious building of steel construction, is under the supervision of a technical engineer who was educated in the United States, and who has done much for the sale of American machinery in Brazil. The "funeral car,"

FIG. 3.—UPPER CITY ENTRANCE TO ELECTRIC ELEVATOR.

shown in Fig. 5, is one of the excellent products of this shop. This car has made a deep impression on the writer, not only because of the fact that its workmanship was excellent, but because of the novelty and practicability of the idea. Instead of using hearses to carry corpses to the cemetery it is the custom of the natives of Bahia to contract for the use of one of these cars, which can be obtained at the following prices: First-class car, $90; second-class, $60, and third-class, $30. The cars are even better than those of American make, due largely to the fact that some of the best woods in the world grow plentifully in Brazil.

Brazil is naturally rich in her various resources, which are yet in the main very much undeveloped. In construction work of buildings, much of the material can be obtained in the country. Stone quarries, for one thing, are plentiful. The rich quarry at Retiro, the property of the Guinle Company, furnished the building stones for the edifice shown in Fig. 1 at a very small cost. A Lockhardt rock crusher, with a capacity of 80 tons of rock per day, is in daily use at this quarry.

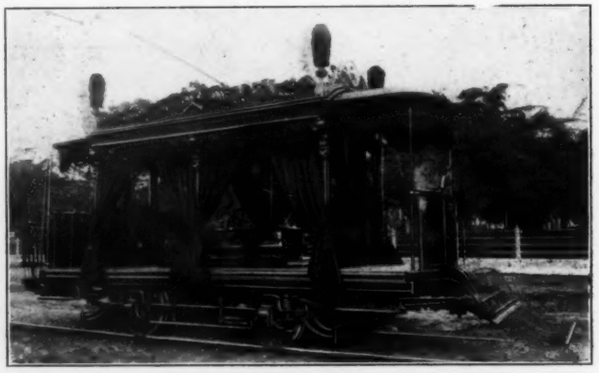


FIG. 5.—FUNERAL CAR.

The head office of the Linha Circular Company is located right on the edge of the bluff of the Upper City, dividing the Upper from the Lower City. Its location, overlooking the beautiful Bay of Espiritu Santo, is simply superb. The offices in this building are tastefully fitted out with furniture, a part of which was made in the States. The illumination is ideal, use being made of Gem units equipped with the proper prismatic reflectors for interior work and arc lamps for exterior duty.

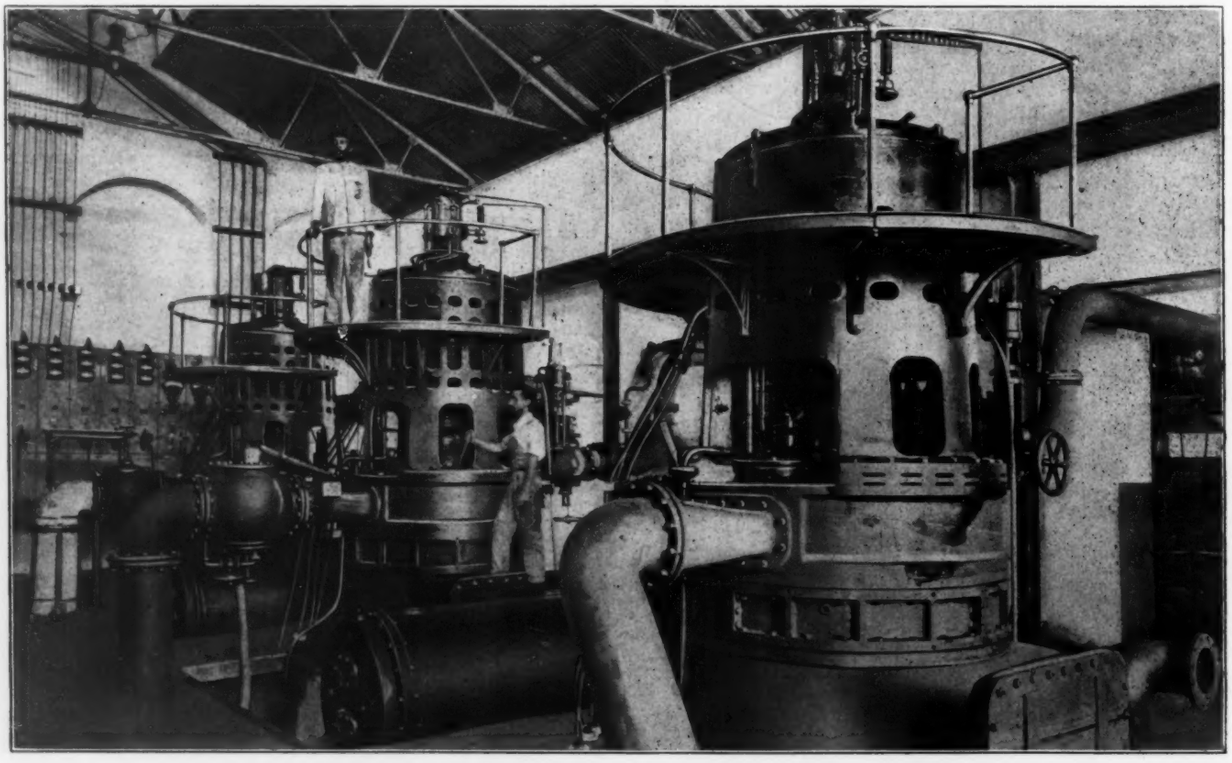


FIG. 4.—TURBO-GENERATOR IN THE PREGUIÇA STATION.

In traveling between the Upper and the Lower City one has his choice of taking an Otis elevator or an inclined-plane railway very similar to the one which ascends Mont Royal, in

Canada. The entrance to this elevator, in the Upper City, is clearly shown in Fig. 3. The two elevators used are 25-hp 600-volt apparatus of the latest pattern. The price charged for making the voyage is 3 cents. The inclined-plane railway is operated by a cable, propelled by a 25-hp steam engine. A cog-wheel arrangement in the center of the track provides for surety against accidents.

The turbines of the Guinle Company are at present greatly overloaded. This condition is not expected to last long, however, as there is now in course of construction a hydro-electric station on the River Paraguassu which, when completed, will furnish enough electric power to fulfil amply all present and future needs.

The illustrations for this article were furnished through the courtesy of Dr. Jules Brandão, technical engineer, and E. Dias Guerra, technical mechanic, both members of the Guinle Company. Therefore this article mainly describes the property of the Guinle Company and does not pretend to give data on the entire extent of the electrical work being done in Bahia, a very large part of which is in the hands of the Bahia Light & Power Company.

Electric Lighting and Railway System in Para, Brazil.

Electricity for the lamps and both stationary and railway motors in Pará, Brazil, is supplied by the Pará Electric Railways & Lighting Company, Ltd., of London. This company operates 35 miles of railway and 14.5 miles of lighting cables.

The power house, which is located on the south side of the Guajara River, contains three Siemens & Halske engine-driven, directly-coupled, 240-kw alternators designed for 50 cycles and 2200 volts; one single-phase Alsacienne generator built for the same service; three 400-kw Dick-Kerr direct-current generators; one E. C. C. 400-kw, 2200-volt, 50-cycle, single-phase generator and one 25-kw, 125-volt, direct-current exciter generator. The engine equipment consists of three 300-hp vertical triple-expansion Sachsische units; one vertical compound Belfont engine; five triple-expansion, three-crank, three-cylinder vertical 585-hp Belliss & Morcom units, and one 40-hp Belliss & Morcom compound engine. Steam is furnished by three Steinmuller water-tube boilers, one Belleville boiler and four Babcock & Wilcox marine-type boilers. These boilers operate at a pressure of 180 lb. per square inch. Each of the B. & W. boilers is fitted with an integral superheater capable of raising the temperature of the steam to 500 deg. Fahr.

Formerly there was a separately driven steam pump for pumping the water from the river for the boilers and for condensing purposes. In its place has been installed one 10-in. Invincible centrifugal pump of Gwynne's make directly coupled to an 18-hp Lancashire Dynamo Company's motor. Water is delivered at the rate of 2000 gal. per minute to a series of settling tanks made of brick and capable of holding 43,000 cu. ft. The water being rather muddy, these tanks are cleaned out every six months. There is a complete purifier and filter plant of Paterson Engineering make. The auxiliary equipment includes three sets of Worthington steam-driven, cross-compound air pumps with jet condensers and two Hayward, Tyler & Company horizontal duplex boiler feed pumps, each capable of pumping 5000 gal. of water per hour against the boiler pressure. There is also one Richardson, Westgarth & Company feed-water heater for raising the temperature of 5000 gal. of water per hour to 75 deg. Fahr. when supplied with 4000 lb. of exhaust steam per hour.

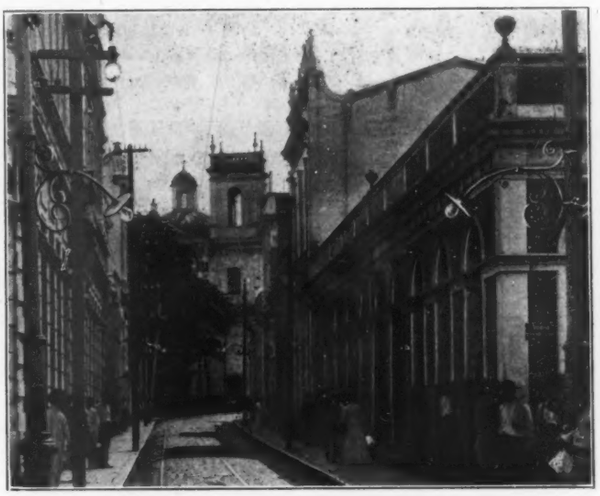


FIG. 2.—ARC AND INCANDESCENT STREET LAMPS.

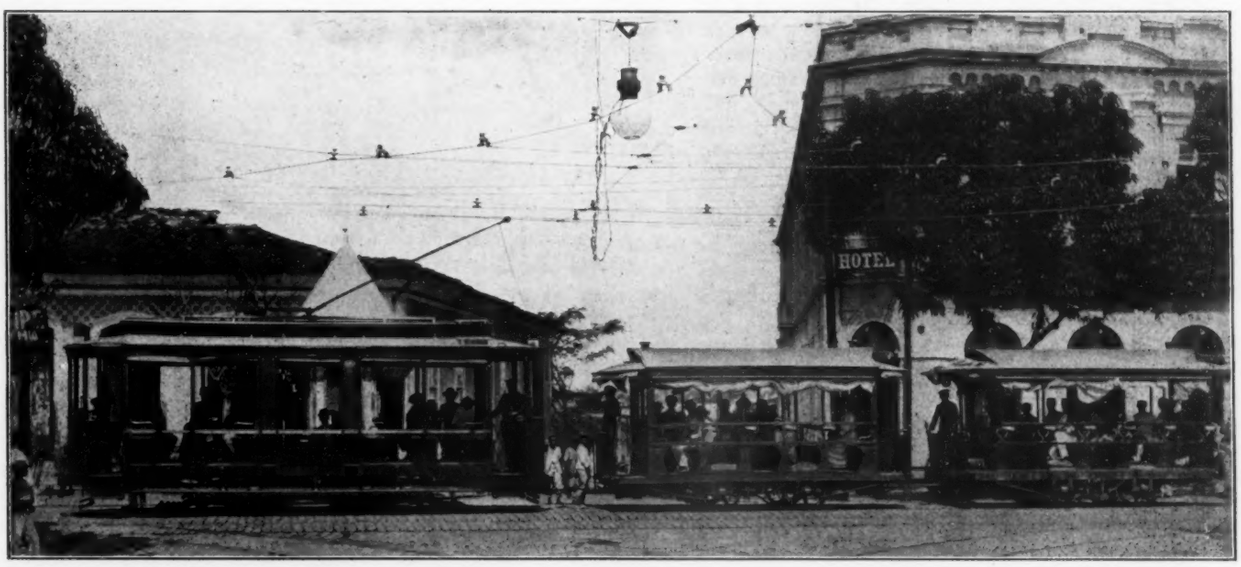


FIG. 1.—STREET LIGHTING AND RAILWAY CIRCUITS IN PARA.

The switchboard gallery is built up of steel framework, supplied by the General Iron Foundry Company, and stands 8 ft. above the engine-room floor. The floor of the gallery consists of 6 in. of concrete, covered with tiles. The switchboard contains all the necessary panels for the railway and lighting loads. The oil switches, isolating switches and lightning arresters are

supported on the underframe of the switchboard gallery. All of the switchboards were supplied by Messrs. Ferranti, Ltd.

At present all of the 2000-volt lighting circuits are being placed underground. The cables are of the Callenders Cable & Construction concentric type. They were tested at the factory with an e.m.f. of 10,000 volts for 30 minutes between conductors and 2200 volts for 30 minutes between outer conductor and earth; when actually laid they withstood satisfactorily 4000 volts for 30 minutes between conductors and 1000 volts for 30 minutes between outer conductor and earth. The concentric cables were laid in standard salt-glazed stoneware troughing, with bridge pieces of different sizes to suit the cables. The

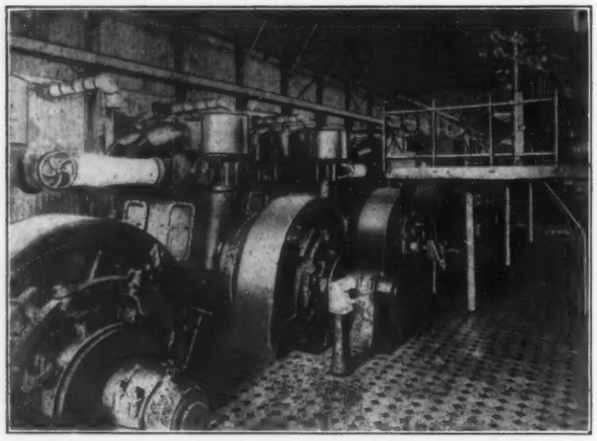


FIG. 3.—INTERIOR OF GENERATING STATION.

troughing was filled in with Trinidad bitumen, and the whole was covered over with hard-glazed stoneware bricks. There are being installed 33 underground-type transformers, of various ratings, suitably located throughout the city. The primary and secondary switches are mounted in Ferranti cast-iron pillars placed above the ground adjoining the transformer pits. Energy will be distributed on the 120-240-volt three-wire system.

The contact for the conversion of the old mule tramways into an electric railway system and for modernizing the lighting system was awarded to J. G. White & Company, Ltd., of London, by the Pará Electric Railways & Lighting Company, Ltd., of the same city, which obtained a 99-year concession in 1905.

The Coefficient of Reflection of Electrical Waves at a Transition Point.

By Louis Cohen.

THE problems of electrical wave propagation are becoming of great importance to the electrical engineer. We meet a great many of these problems in the various phenomena which may arise in high-tension transmission and distribution of electrical power. It is to be hoped that the very instructive and illuminating paper of Professor Steinmetz on "The General Equations of the Electric Circuit," which appeared recently in the *Transactions* of the American Institute of Electrical Engineers, will stimulate many others to discuss the many interesting problems which are apt to come up in connection with this subject.

In this brief contribution I wish to develop the expressions for the ratios of the reflected and transmitted waves to the incoming waves at a transition point. The results agree with those obtained by Professor Steinmetz, but the method of treatment is different and it will probably be of interest.

Professor A. G. Webster, in his discussion of a paper before the American Institute of Electrical Engineers, once remarked that he seldom spends many weeks on a problem of electrical oscillations until he has looked over Mr. Heaviside's papers. It is generally there, and so it is in this case. In his "Electromagnetic Theory," Vol. 2, page 79. Dr. Heaviside devotes a paragraph to the discussion of this problem and he derives the following expression for the reflection coefficient,

$$\eta = \frac{V_2}{V_1} = \frac{Z_1 - \frac{R}{q}}{Z_1 + \frac{R}{q}}$$

where V_1 and V_2 are the potentials of the incoming and reflected waves, Z_1 is the resistance operator of the terminal apparatus and q is a certain differential operator which is discussed at length in his books. To express η in terms of the constants of the electrical circuits would presuppose a knowledge of the operation of q, but since generally electrical engineers are not acquainted with Dr. Heaviside's methods, we will proceed to translate it into ordinary algebra:

Let V_1 denote the potential of the incoming wave.
" V_2 " " " " " " reflected wave.
" V_3 " " " " " " transmitted wave.

Let us suppose that the potential consists of a single wave; generally it consists of more than one wave, but as far as the transition point is concerned what will be true of one wave will be true of any number of waves. The general expression for the wave developed along a line of uniform distributed capacity and inductance is*

$$V = Ae^{-\alpha s}\cos(pt - \beta s) \qquad (1)$$

If we neglect the resistance, which we will do in this case, then $\alpha = 0$ and $\beta = p\sqrt{LC}$. Now let L_1, C_1 and L_2, C_2 be the inductance and capacity of the line on the different sides of the transition point, then we shall have the following expressions for the potentials:

$$\left.\begin{aligned} V_1 &= A_1\cos(pt - \beta_1 s) \\ V_2 &= A_2\cos(pt - \beta_1 s) \\ V_3 &= A_3\cos(pt - \beta_2 s) \end{aligned}\right\} \qquad (2)$$

The currents corresponding to these potentials can be derived, of course, by the aid of the well-known relation

$$c\frac{dV}{dt} = -\frac{dI}{ds}$$

and hence we get

$$\left.\begin{aligned} I_1 &= \frac{C_1 p}{\beta_1} A_1\cos(pt - \beta_1 s) \\ I_2 &= \frac{C_1 p}{\beta_1} A_2\cos(pt - \beta_1 s) \\ I_3 &= \frac{C_2 p}{\beta_2} A_3\cos(pt - \beta_2 s) \end{aligned}\right\} \qquad (3)$$

At the transition point the potential will be the sum of the incoming wave and the reflected wave, while the current will be represented by the difference of the two waves since they travel in opposite directions. At the point of transition there is no discontinuity of any sort, hence we must have the following relations satisfied:

$$\left.\begin{aligned} (A_1 + A_2)\cos(pt - \beta_1 s) &= A_3\cos(pt - \beta_2 s) \\ \frac{C_1 p}{\beta_1}(A_1 - A_2)\cos(pt - \beta_1 s) &= \frac{C_2 p}{\beta_2} A_3\cos(pt - \beta_2 s) \end{aligned}\right\} \qquad (4)$$

The ratio of these two equations will give

$$\frac{A_1 + A_2}{A_1 - A_2} = \frac{C_1\beta_2}{C_2\beta_1}$$

and

$$\frac{A_1 + A_2}{A_1 - A_2} + 1 = \frac{2A_1}{A_1 - A_2} = \frac{C_1\beta_2 + C_2\beta_1}{C_2\beta_1}$$

or

$$\frac{A_1 - A_2}{2A_1} = \frac{1}{2} - \frac{A_2}{2A_1} = \frac{C_2\beta_1}{C_1\beta_2 + C_2\beta_1}$$

$$\therefore \frac{A_2}{A_1} = \frac{C_1\beta_2 - C_2\beta_1}{C_1\beta_2 + C_2\beta_1} \qquad (5)$$

$\frac{A_2}{A_1}$ is the ratio of the reflected to the incoming wave. If we

*See Bedell and Crehore, Alternating Currents, p. 190.

replace β_1 and β_2 by their corresponding values, $p\sqrt{L_1C_1}$ and $p\sqrt{L_2C_2}$, and then simplify a little we get

$$\frac{A_2}{A_1}=\frac{\sqrt{\frac{L_2}{C_2}}-\sqrt{\frac{L_1}{C_1}}}{\sqrt{\frac{L_2}{C_2}}-+\sqrt{\frac{L_1}{C_1}}} \qquad (6)$$

The ratio of the transmitted wave to the incoming wave can be obtained in the following way. We have by equation (4) the following relation between the amplitudes of the different waves:

$$A_1+A_2=A_3.$$

Replacing A_2 by its value in terms of A_1 from equation (5) we get

$$A_1\left\{1+\frac{C_1\beta_2-C_2\beta_1}{C_1\beta_2+C_2\beta_1}\right\}=A_3$$

Therefore,

$$\frac{A_3}{A_1}=\frac{2C_1\beta_2}{C_1\beta_2+C_2\beta_1}=\frac{2\sqrt{\frac{L_2}{C_2}}}{\sqrt{\frac{L_2}{C_2}}+\sqrt{\frac{L_1}{C_1}}} \qquad (7)$$

Equations (6) and (7) agree with the results which have been obtained by Professor Steinmetz. See his equations (141), (142) and (143).

The relations between the reflected and transmitted waves to the incoming wave as given by equations (6) and (7) are only applicable to the case where the wave in passing the transition point continues its travel in the form of a wave; that is, we have distributed inductance and capacity on both sides of the transition point. In the case, however, where at the transition point we have a lumped inductance and capacity, the conditions are different.

Let us denote the impedance of the apparatus at the transition point by Z, and, as before, we will denote the potential of the incoming wave by $V_1=A_1\cos(pt-\beta s)$, that of the reflected wave by $V_2=A_2\cos(pt-\beta s)$. The currents corresponding to these two waves will be

$$I_1=\frac{Cp}{\beta}A_1\cos(pt-\beta s) \text{ and } I_2=\frac{Cp}{\beta}A_2\cos(pt-\beta s)$$

Now at the transition point, the potential is the sum of the separate potentials of the incoming and reflected waves, and this must equal the drop on the terminal apparatus, which is supposed to be grounded.

We have, therefore,

$$V_1+V_2=ZI,$$

but the current at the transition point is the difference of the incoming and reflected wave, since they travel in opposite directions, hence we have

$$V_1+V_2=Z(I_1-I_2).$$

Introducing the values of V_1, V_2, I_1 and I_2 we get:

$$(A_1+A_2)\cos(pt-\beta s)=\frac{pCZ}{\beta}(A_1-A_2)\cos(pt-\beta s)$$

From which we obtain,

$$\frac{A_1+A_2}{A_1-A_2}=\frac{pCZ}{\beta}$$

Proceeding in the same way as we did in deriving equation (5), we obtain,

$$\frac{A_2}{A_1}=\frac{pCZ-\beta}{pCZ+\beta} \qquad (8)$$

If we denote the inductance and capacity of the terminal apparatus by L_1, C_1, and neglect the resistance, we have $Z=pL_1-\frac{1}{pC_1}$. Replacing also β by its corresponding value $p\sqrt{LC}$, equation (8) will become

$$\frac{A_2}{A_1}=\frac{C\left(pL_1-\frac{1}{pC_1}\right)-\sqrt{LC}}{C\left(pL_1-\frac{1}{pC_1}\right)+\sqrt{LC}} \qquad (9)$$

In the case of a free oscillation, we have $p=\sqrt{\frac{1}{LC}}$

Therefore,

$$\frac{A_2}{A_1}=\frac{\left(\frac{L_1}{\sqrt{LC}}-\frac{\sqrt{LC}}{C_1}\right)-\sqrt{\frac{L}{C}}}{\left(\frac{L_1}{\sqrt{LC}}-\frac{\sqrt{LC}}{C_1}\right)+\sqrt{\frac{L}{C}}} \qquad (10)$$

The rise of potential at the terminal, or the ratio of the maximum potential at the transition point to that of line will be

$$\frac{A_2+A_1}{A_1}=\frac{2\left(\frac{L_1}{\sqrt{LC}}-\frac{\sqrt{LC}}{C_1}\right)}{\left(\frac{L_1}{\sqrt{LC}}-\frac{\sqrt{LC}}{C_1}\right)+\sqrt{\frac{L}{C}}} \qquad (11)$$

If the inductance of the terminal apparatus is very high, we may then write approximately equation (11) in the following form:

$$\frac{A_2+A_1}{A_1}=\frac{2L_1}{L_1+L}$$

The voltage may, therefore, rise to nearly twice the voltage of the line.

Bureau of Standards,
Washington, D. C.

A Comparison of the Methods of Starting Squirrel-Cage Induction Motors.

BY SELBY HAAR.

THE squirrel-cage type of induction motor has long been a favorite for all sorts of industrial purposes on account of its many advantages, and it is being installed in ever-increasing numbers. The first motors were quite small—in fact, the development of large sizes may be said to have occurred within the last decade. The small motors caused no trouble when connected directly to the line, but the larger ones soon attracted the unfavorable attention of the central-station operators on account of the large starting currents, especially on circuits where close regulation was attempted. When the necessity of a starting device was recognized, the most obvious solution was a series resistance such as was used with direct-current motors. There was also developed a transformer starter; it is to compare the merits of these two types of starters that this article is written.

The only recommendation of the rheostatic starter used in the primary circuit is its low first cost. It can be constructed of cheap materials by unskilled labor, and can therefore be put on the market at a price far below that of the transformer starter. In its performance the rheostatic starter is always inferior to the transformer starter.

A motor with squirrel-cage rotor which has a torque at start of 175 per cent of the full-load value will probably have a maximum torque of from 1.5 to 2.0 times that of the starting torque.

Fig. 1, which is plotted with speed as abscissas and torque at constant impressed e.m.f. as ordinates, shows the variation of the torque of such a motor during acceleration. It will be noted from the curve that the torque increases as soon as the motor starts, the rate of increase being slower at first than it is near the maximum torque point. For the usual type of load, where the flywheel effect is not predominant, the torque required at start to overcome the static friction is much greater than that necessary to accelerate the motor after it is started, so that usually no trouble is experienced in bringing a motor up to proper speed with the same applied e.m.f. as is sufficient to start it, because the "static friction" is much larger than the running friction.

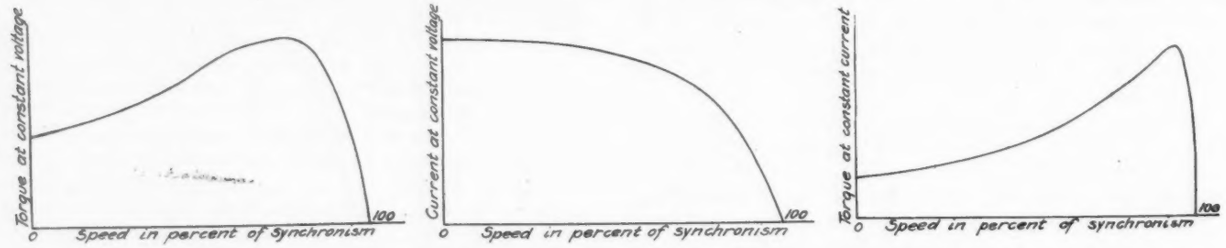
From the current curve of Fig. 2, which is plotted with speed as abscissas and current at constant impressed voltage as ordinates, it will be seen that the current is greatest at the instant of starting, decreases slowly to a point corresponding to about three-fourths speed, and then decreases rapidly from there on.

The slowness of the decrease in the current causes a reduction in the effectiveness of the primary-circuit rheostatic type of starter. Unless the rheostat is very liberally designed—which means higher cost—the starting current will heat it to a high temperature, which will increase its resistance, and lower the voltage impressed on the motor and thereby decrease the torque.

An objection has been raised against the transformer type of starter for conditions requiring increasing torque as the speed increases. Where this is a real condition, it could be handled by a multi-step auto-transformer, but it is required so infrequently that one large manufacturing company is said to be changing from the multi-step to the single-step design. There is no essential difference between the two methods of starting in regard to increase of torque, the rheostat producing the effect of a motor with an extremely high primary resistance. As a matter of fact, Fig. 1 herewith represents the torque variation with rheostatic starting just as well as with transformer starting.

A very instructive method of investigating the conditions during starting is by constructing a torque-per-ampere curve. Fig. 3, plotted with speed as abscissas and torque at constant current as ordinates, is such a curve; it shows that there is little, if any, advantage in the primary-circuit rheostatic method in this respect. The increase in torque per ampere with change in speed is inherent in the type of motor.

No matter what method of starting of a squirrel-cage motor is used, the starting torque required determines the minimum voltage which must be impressed on the motor; there must be sufficient torque to ovecome the counter-torque of the load.



FIGS. 1, 2 AND 3.—TORQUE AND CURRENT RELATIONS IN A SQUIRREL-CAGE INDUCTION MOTOR.

The best design of starter provides the required voltage with the least disturbance to the supply system. The disturbance can be judged by the relative currents taken. Select, therefore, a 50-per-cent voltage tap—which will handle most cases—and assume a starting current of a squirrel-cage motor of six times the full-load value at full voltage; the line current would be three times the full-load value with the rheostat and five times the full load with a transformer starter. The smaller line current—about half the larger—with the transformer will appeal to the underwriters and perhaps permit a slight saving in the wiring. The difference in current will be negligible in a small motor, but for such a motor a starting device is scarcely necessary.

As to the burning of contacts during starting, it is possible to operate either type so as to break the circuit when the current is small. Usually—as stated above—the lower transformer voltage will accelerate the rotor to a proper speed, and the current to be broken is the no-load current at the reduced voltage.

With a rheostatic starter the current which is to be broken is also the no-load current, but it is the current corresponding to a higher voltage. The rheostatic starter has an advantage in that the motor voltage is nearer the line voltage so that there is a smaller current rush at the instant of connecting the motor to the line than there would be with a compensator.

In view of the above considerations it can be stated that when the rheostatic and transformer methods of starting squirrel-cage induction motors are compared on the basis of torque, current, etc., the conclusion is reached that the only recommendation of the rheostat is its lower price.

An Electric Charging Launch.

Although electricity has several decided advantages as a power for launches and yachts, such as entire freedom from danger of fire or explosion and absence from noise, heat, vibration, smoke and foul odor, it is subject to the limitation that any long-distance cruising is impracticable unless charging facilities can be found at intervals along the route.

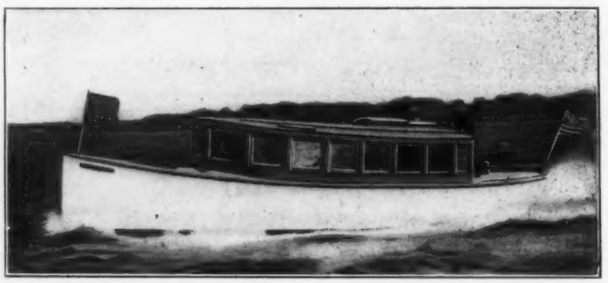


FIG. 1.—ELECTRIC-GASOLINE CHARGING LAUNCH "KILOWATT."

With a view to overcoming this objection, and to enable him to make long trips independently of charging stations on shore, Mr. Benjamin Douglass, Jr., of New York, has had built for him by the Electric Launch Company, of Bayonne, N. J., a unique floating charging plant to be used as an auxiliary to his handsome electric yacht *Cascapedia*. It is the first craft of its kind and the builders believe that it solves the question of the use of electricity in large yachts, since it can be operated at full power for 100 hours on one filling of the fuel tank, thus enabling the yacht to make a trip of 2000 miles before either craft would have to enter port.

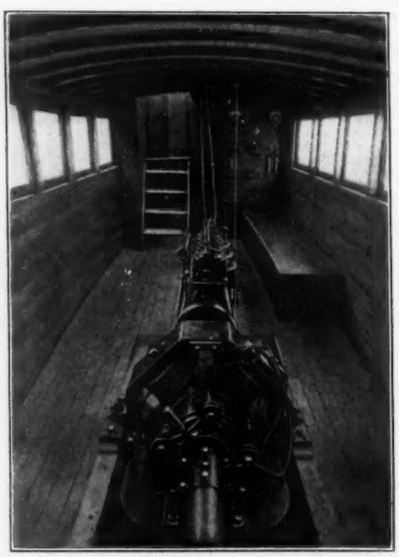


FIG. 2.—CHARGING OUTFIT OF "KILOWATT."

The name of this unique little boat is the *Kilowatt*, and

following completion, she was shipped to Palm Beach, Fla., where her owner used her during the winter. With the recharging launch as an auxiliary, the yacht *Cascapedia* is not dependent upon electricity ashore for charging her batteries. The *Kilowatt* is 35 ft. long, 9 ft. beam and 2 ft. draft. She is of the glass cabin type, with plate-glass drop windows and brass hinged ports. The hull is of very substantial construction with a spacious after deck to permit the seating of a party. The steering wheel is located on the after deck, together with engine control devices which enable one man to steer the boat and manage the engine.

The unique feature of the boat is her power equipment, which consists of a 40-hp, six-cylinder gasoline engine, with mechanical reverse gear connected to the propeller shaft. A 30-kw dynamo is directly connected to the crank-shaft at the forward end of the engine, as shown in the photograph. A slate switchboard is located on the port side of the cabin, with the necessary instruments and with switches for switching the electricity generated by the dynamo into the batteries of the electric yacht. The dynamo is so arranged that current can be generated while the boat is lying at anchor or when under way. The plant has sufficient capacity for recharging the yacht's batteries in three or four hours. The charging launch has a speed under her gasoline power of nine miles an hour and carries 400 gal. of fuel, on which she can be operated for 100 hours and recharge the yacht 10 or 12 times. On one charge of her batteries, the yacht can run 200 miles, and in connection with the auxiliary launch her radius is unlimited.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Daylight-Saving Legislation.

As noted in the daily papers recently, an attempt is being made to interest the United States Congress in a daylight-saving law which has been favorably recommended by a committee of the House of Commons of the English Parliament. This plan in effect utilizes some of the early morning daylight during the summer months and does away with a part of the necessity for artificial light in the evening during those months. The plan is to set the hands of the clock ahead 20 minutes each Sunday in April and set them back 20 minutes each Sunday in September. The effect of this is, of course, to give most people the benefit of an hour and 20 minutes more daylight in the evening, thus dispensing with artificial light for that period and giving more time for daylight recreation in summer. Owing to the inherent merit of the plan it would not be at all surprising if it were ultimately to be adopted both in England and this country, although legislation of this kind is likely to be slow. Its possible effect on electric lighting revenues is worth thinking about in making future plans. The total influence on yearly revenues would not be as great as might be thought on hasty consideration, as its chief effect would, of course, be on the revenue from residence lighting in all cities and from store lighting in small towns. Even in small towns, however, it is customary for stores to be closed after dark with the exception of one or two nights per week, so that the summer revenue from store lighting in such stores as are closed early in the evening is small. In residence lighting, where there is no minimum bill, the midsummer gross monthly revenue is only 5 per cent or 6 per cent of the yearly revenue. The minimum bill, however, tends to even up this difference, and companies having minimum bills would probably lose very little as a result of such legislation. In the case of companies having no minimum bill, the summer revenue would be cut, but this cut would be only a fractional percentage of the yearly income. However, this reduction would come during the months when the central station has the least work to do and when it can least afford to lose the revenue. The possibility of such daylight-saving legislation emphasizes the importance of renewed efforts to secure non-peak business, and especially business during the summer months. Refrigerating and waterworks pumping are the two classes of load which are most valuable for helping a central-station company to hold up its summer revenues.

Relation of the Central Station to the Electric Automobile Business.

At the recent convention in San Francisco of the Pacific Coast Electric Vehicle Association, Mr. Fred. T. Kitts, of Sacramento, presented a paper with the above title, in which he pointed out the advantages to the central station of an electric automobile charging load.

Many central stations, he said, do not as yet make a sufficiently low rate for this class of business, which fact must be due to their not having considered the question carefully, as otherwise they would realize the advantage of selling energy at non-peak hours to be used for pleasure vehicles, delivery wagons and trucks during the day, and would make a rate low enough to encourage the adoption of electrically propelled vehicles and thereby very materially increase their revenue.

Mr. Kitts stated that the electric pleasure vehicle has already displaced thousands of horses and that the modern electric truck is now coming into favor so fast that it will not be long until horse-drawn vehicles will be the exception; and when one considers the thousands of horses still plodding along the streets, the tremendous demand there will be for central-station charging current when these changes are made is evident. Many central-station people are beginning to realize the great opportunity that the electric vehicle business has to offer them and find that a little effort spent in encouraging the use of such vehicles is handsomely repaid by a permanent and desirable load connected to their mains, the securing of which requires practically no extra investment as nearly all the energy for charging vehicle batteries is used when the load on a station is light and the station apparatus would otherwise be idle.

Many central stations now spending thousands of dollars for maximum-demand indicators and other devices, and using complicated systems of accounting to improve their load factor, are finding out that the electric vehicle, in combination with other motors, is solving their problem automatically. One customer may have a high maximum demand on a lighting load, another on a power load, another on a vehicle battery. The resultant of all these is not only to keep down sharp peaks in the load curve, but, also, on account of this improvement of the load factor, enables the station to make a lower rate on all of its energy, thus encouraging greater consumption and giving a larger income.

Central-station people in looking back over their experiences can see where the popular use of the electric motor has enabled them to reduce the price of energy in general, none can regret the encouragement they offered to power business for it has built up for them a day load which keeps the station and distributing apparatus earning something during the day as well as during the evening. As to the electric vehicle, in the daytime, when the station is supplying energy for industrial purposes, and during the evening, when its product is being used for lighting, the automobile is busy using up energy stored the night before and is willing to wait until the lighting customers are satisfied before again making any demand on the station. For this reason the central station should make a very low rate for vehicle battery charging, as it is by far the most desirable business that can be secured. In cases where there would be a possibility of the charging being done at the peak, a clause could be inserted in the contract whereby a penalty would be attached for using power during certain

hours and which could be made large enough to deter customers from taking the risk of being caught violating this contract.

The central station should make an especial effort to encourage private garages and should make the rate so low that anyone who can afford to keep a horse can afford an electric automobile.

Many Eastern central stations have large garages for the care of their own machines and have discarded horse-drawn vehicles entirely, doing their heavy trucking as well as making their business calls with electrics. In this way they not only set an example to the public, but find that they save money, aside from the advertising feature which is secured by the use of such up-to-date business methods. The operation of a modern central station in connection with its necessary distributing business requires many vehicles of different classes, from the light runabout to the five-ton truck, and the central station should be the first to discard horses and thus hasten the day when electricity will be the only source of power used for all city transportation.

Interesting Facts in Des Moines Central-Station Practice.

The Des Moines Electric Company, of Des Moines, Ia., which does all the electric lighting and power business of that city of 85,000 inhabitants, has been industriously at work improving its conditions during the past few years, and some notes on its improved methods and results will be of interest. This

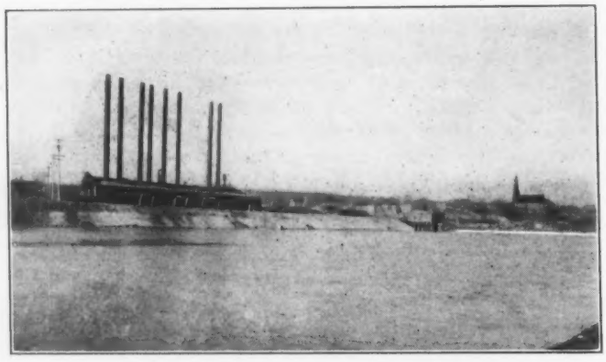


FIG. 1.—STEAM PLANT AND DAM.

company has two stations near each other on the west bank of the Des Moines River (see Fig. 1). One of these is a water-power plant of small capacity. The other is a large steam plant, interior views of which are shown in Figs. 2 and 3. The system of distribution is direct current in the downtown districts and alternating current in other parts of the city.

IMPROVEMENTS AND CHARACTER OF LOAD.

In the year 1908 the output was 6,504,715 kw-hours, an increase of 22 per cent over 1907. The peak load for 1908 was 2885 kw, an increase of 18 per cent over 1907. It is thus seen that the company's load is improving in the right direction; that is, the output is increasing more rapidly than the peak, indicating that the management has appreciated the importance of securing business which has a good load factor. The load factor was 23.7 per cent in 1907 and 25.6 per cent in 1908 as a result of the improved conditions.

The connected power load at the end of 1908 was 4730 hp, an increase of 11.3 per cent over 1907. By comparing the 2885-kw load with the 3200-kw station capacity it is seen that the company still had an ample machinery reserve over and above its peak load. The output for November, 1908, as compared with November, 1907, showed a 32.9 per cent increase.

While it is difficult to locate definitely all of the causes of the improvement in load factor, undoubtedly one of the things which has contributed to it has been the successful efforts of the company to increase its flat-rate window, sign and outline lighting. At the end of 1908 3.35 per cent of the total income was from this class of business. The rate offered on this flat-rate lighting, which is turned on and off by the company's patrolman at specified hours, is such that the consumer's bill is the same as if he were on a meter and used his sign or window installation the same number of hours per year as under the flat-rate contract. These regular meter rates in Des Moines

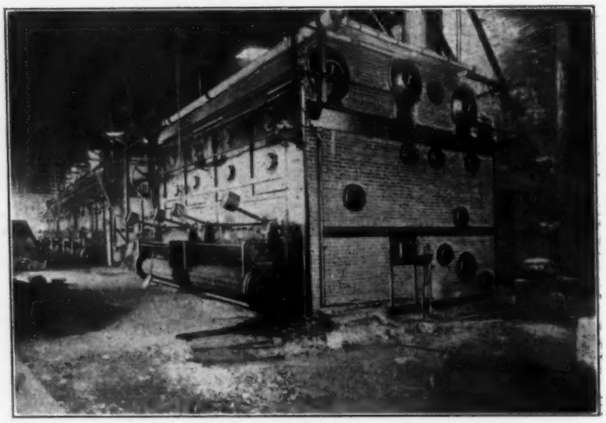


FIG. 2.—BOILER ROOM.

are 12 cents per kw-hour for the first kw-hour used per 25 watts connected per month. This is practically the equivalent of 40 hours' use per month of the consumer's connected load. For all energy used in excess of 1 kw-hour for each 25 watts connected the rate is 6 cents per kw-hour. In residences the full connected load is not taken, but only 33 per cent is used in figuring the installation upon which the 12-cent rate is based.

LAMP-POSTS IN THE DOWN-TOWN DISTRICT.

A movement was begun in 1908 and has been rapidly gaining headway to install ornamental iron lampposts at frequent intervals along the curb line on the down-town streets. Twenty of these posts were installed by the end of 1908, and 45 more are under way. The posts used are similar to those extensively employed on the streets of St. Paul, Minn. They carry five 50-cp, 125-watt, Gem lamps each. There are four bracket arms and one central globe on the top of the post. The posts are paid for by the tenants and property owners along the street. Energy is supplied to them by the company at a cost which figures about 5 cents per kw-hour. The company maintains the lamps and glassware and paints the posts. It also installs these posts as near cost as possible. It guarantees, however, that the cost of installation shall not be over $100 per post. The actual cost

FIG. 3.—ENGINE ROOM.

averages about $85 each. The cost of the posts f.o.b. Des Moines is about $60. Fig. 4 shows these posts as erected on one of the down-town streets.

DISTRIBUTED METER READINGS.

A plan was put in force last year by Mr. P. B. Sawyer, general manager, over which he is very enthusiastic because of the

smoother workings of the meter reading organization which has resulted. Instead of reading all the meters at or near the end of the month, as formerly, and causing a great congestion of work at meter-reading periods, meters are now read and customers billed continuously every working day in the month. The old plan, pursued by many companies, was that of calling in every available man for meter reading, drawing on the line and other departments to get enough men to read the meters within the specified limits, 10 men being required for meter reading. Then the clerical force would be overworked for several days getting out the bills. During this meter-reading period other work was neglected both by the bookkeeping department and by the men taken from other departments for meter reading.

Under the new plan one man reads every month the total number of 3249 meters which the company has connected. The territory is divided into 25 sections, each of which represents one day's work for the meter reader. The number of consumers in a section is made dependent on the congestion of the district, fewer meters being assigned to the scattering outlying districts. For each section there is one meter book representing one day's work, in which the leaves are arranged, as usual, by routes. For convenience in billing, the consumers' ledger, which is of the loose-leaf type, is also arranged by routes, and the addressograph list is arranged in the same way. Thus there is no turning back and forth in the process of making out consumers' bills from the meter-route books as all the

FIG. 4.—WALNUT STREET AT NIGHT.

lists pertaining to meter reading and billing are in the same order. The consumers' ledger is indexed so that consumers can be found by name.

This plan works the meter reader and billing force steadily. There is no necessity for extra work and overtime during a part of the month. The one man who makes it his entire business to read meters is more expert than the corps of men formerly needed. The chances of error in making out bills are also reduced, because there is no congestion of work at any one period of the month. That the system is entirely practical is shown by the fact that the new plan has eliminated 80 per cent of the errors in meter reading, and the monthly grist of complaints regarding bills has been reduced from the old average of 20 to 25 each month to about one-third. Another advantage of the plan is that it insures payment of bills within a shorter time after the actual meter readings are made. Under the old plan meters were read on the twenty-second of the month and bills were sent out the first. Consequently the gross income of the company was tied up in the accounting department from the twenty-second to the first of each month. Bills are now sent out within one or two days from the time of reading. The only disadvantage of the plan, and that is rather of a bookkeeping nature, is that there is no distinct line between the gross earnings of one month and another.

IMPROVEMENTS IN METER MAINTENANCE.

The lost and unaccounted-for energy between the station busbars and the consumers' meters on the direct-current system is about 15 per cent, and on the alternating-current system about 20 per cent, indicating an excellent condition of meters and low line and transformer losses. Considerable improvement has been made recently in methods of maintaining accuracy of meters under Mr. W. C. Sharp, the general superintendent of the company, who was formerly in charge of the meter department of the New York Edison Company. Formerly the company made it a practice of testing meters for accuracy at frequent intervals, but owing to the methods used by the meter testers in recalibrating and correcting meters, the management is now convinced that much of this work was wasted, as meters would not stay calibrated very long after a meter-tester's visit. For example, on a commutator-type meter it is not conducive to accuracy to polish up the commutator and assume that if the meter is correct when the commutator is first polished it will remain correct after its surface has gone back to regular working conditions. Again, it is not sufficient to move the retarding magnets on the meter to make it run faster when the real trouble is in a worn-out jewel.

A new plan of meter calibration has been put in operation by Mr. Sharp which will be watched with interest by central-station companies having many meters. The most common plan adopted by well-organized meter departments has been to test meters at intervals dependent on the number of revolutions made by the meter per month, or dependent upon the number of kw-hours used per month. The new plan being tried in Des Moines is to classify meters according to the amount of inaccuracy they have shown in the past. Meter-testing records are kept by a card index. If a meter shows considerable error in a certain test its card is placed in a division calling for more frequent testing than if it had showed greater accuracy. The time between tests of meters is from 3 to 18 months, meters in the three months' class being those which have shown the greatest accuracy on the last test. Of course, some kinds of meter errors are caused by the peculiar location of the meter. The cards of such meters would probably remain permanently in the section devoted to meters which are to receive the most frequent tests. Whenever a meter is tested its card is not necessarily placed back in the section calling for the same frequency of testing as before. It may be assigned to another section calling for a greater or less frequency of testing, depending on its degree of inaccuracy at the time of the last test.

HANDLING MOTOR BUSINESS.

The company does not aim to do an extensive electrical supply business, but it sells motors and heating appliances. It does no wiring, but makes small repairs for customers. For use in delivering motors and similar heavy work the company maintains a one-ton electric truck, which has been found to make money by saving labor.

INTERIOR WIRING AND ILLUMINATION

Mercury-Vapor Lamps in Orchestra Hall, Chicago.

An interesting application of mercury-vapor lamps has been made in lighting the stage of Orchestra Hall, Chicago. This is a concert hall at which regular performances are given by the famous Thomas Orchestra. The lighting of the stage was complained of by the musicians in the orchestra because of the insufficient illumination on the music. The lighting of the entire hall was by incandescent lamps, concealed from the view of the audience as much as possible. The lighting of the stage was accomplished by similar lamps placed high behind the proscenium arch, out of sight of the audience. The illumination on the music scores of the orchestra was obtained partially by direct light from these lamps and partially by reflection from the light-colored sound shell back of the stage.

This illumination being insufficient, it was recently supple-

mented by the light of four Cooper Hewitt mercury-vapor lamps. These lamps, if used alone, would, of course, not be satisfactory owing to the character of their light. With the large amount of light from common incandescent lamps, however, the mixture of the yellow light of the incandescent with the greenish-blue of the mercury-vapor produces a light of satisfactory color and increases the illumination on the music scores to a satisfactory point.

Wiring with Metal Molding.

Although like wooden molding, metal molding can be used for exposed work only, it is considered to be an advance over the former and to be almost on a par with exposed conduit, notwithstanding it is not so strong as the latter. The requirements for its installation are somewhat similar to those for the installation of conduit. The molding must be continuous from outlet to outlet and must at all outlets be provided with approved terminal fittings. The metal of the molding must be permanently and effectively grounded and must be so installed that adjacent lengths of molding will be mechanically and electrically secured at all points. For alternating-current systems both wires of the circuit must, of course, be placed in the same molding.

Metal molding is at present manufactured by a number of companies, and all the fittings necessary to a complete installation can also be obtained. The base can be bent to short radius and formed into many irregular shapes by a person skilled in handling the product. A wireman capable of handling conduit ought not to experience any difficulty in installing metal molding. The molding is cut by simply scoring it with a file, when it may be broken in two. The capping is easily and quickly snapped in place. A base coupling is used at joints and at fittings in order to insure electrical continuity throughout and effective grounding. The base is usually furnished with countersunk holes for screws and bolts, and, with the capping, comes in standard lengths. The system is in reality a covered raceway so that wires can be removed and changes made within a minimum of time.

Outline Lighting in Rochester, N. Y.

Owing to the requirements of the underwriters and city offi-

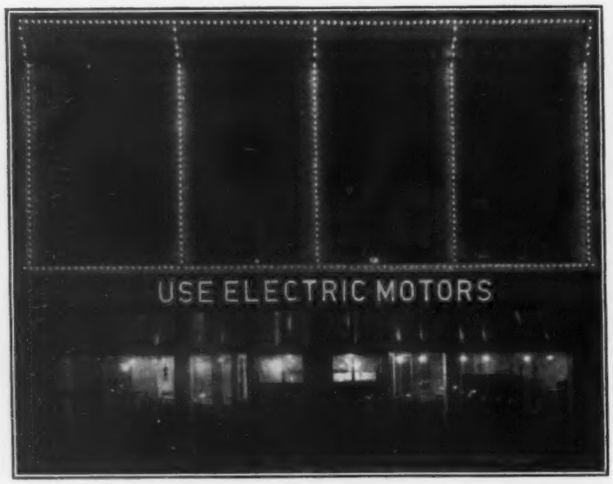


FIG. 1.—OUTLINE LIGHTING OF OFFICE.

cials there are very few electric signs in Rochester, N. Y. However, a number of merchants of their own volition have outlined their buildings with electric lamps and the amount of such illumination is increasing. The outline lighting, with few exceptions, is confined entirely to Main and State Streets. No attempt is made at elaboration, the sides and top of the buildings being merely brought out. Work of this kind must be done with conduit, so the expense is not small. Lamps of 4 cp are used and these are turned on at dusk and kept lighted until midnight. The Rochester Railway & Light Company does not, however, have any part in this work. The connected load, which now amounts to about 500 kw, came to it without solicitation; one merchant starting outline lighting and the others

FIG. 2.—MAIN STREET, ROCHESTER.

following for business reasons. The lamps are turned on and off by the merchants themselves and all the energy used is charged for at regular meter rates, there being no flat-rate outline lighting, the latter being fed from the regular lighting circuits. The number of lamps employed on 11 buildings thus out-

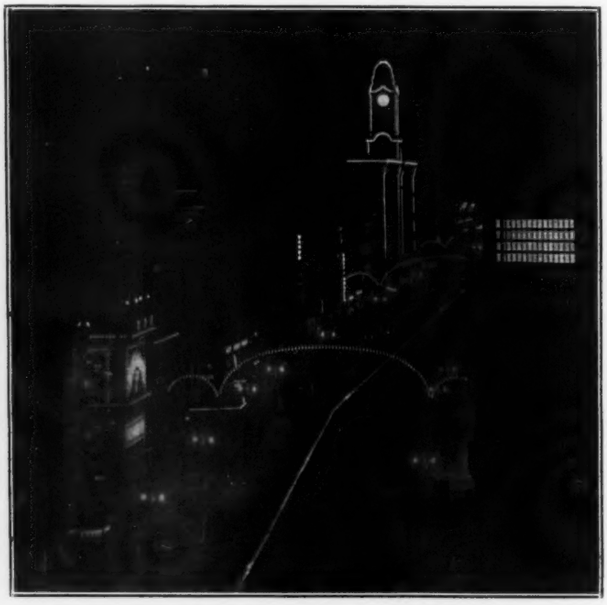


FIG. 3.—MAIN STREET, ROCHESTER.

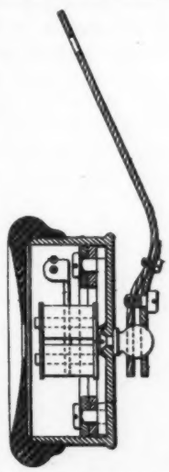
lined is over 15,000. The accompanying illustrations show two views of Main Street and also a view of the office of the Rochester Railway & Light Company on Clinton Street. The arches shown in the street do not form part of the street illumination, having been erected temporarily while a political convention was held in the city.

New Telephone Patents.

TRANSMITTERS AND RECEIVERS.

There now seems to be no doubt of the efficacy of the telephone in enabling those afflicted with certain forms of deafness to hear. As each additional user renders the use of the apparatus less conspicuous, and therefore less objectionable, the result is a very marked increase in the importance of this branch of the art. This condition is reflected by the number of patents issued for improvements for such instruments. The transmitter problem is different from that of usual service, as the audiphone transmitter must be designed to "pick up," not exclude, the maximum of extraneous sounds. The receiver problem is merely that of a comfortable head receiver. There have recently been issued two patents for audiphone instruments. In one of these Messrs. C. H. Viggars and E. H. Stolz, of Chicago, have described their joint invention, which covers a transmitter. Use is made of a carbon diaphragm, opposing the middle of the rear face of which is a carbon block, not quite touching it. This latter has several cylindrical holes with axes sloping upward to the rear, and each is loaded with a single string of carbon granules or balls, not quite of the diameter of the hole. These are retained through their contact with the diaphragm.

H. E. Sullivan, of London, England, is the inventor of another improvement in head receivers. In the accompanying illustration will be noted the ball-and-socket attachment of the head band, providing for every practicable angular relation of the ear-cap and the head band. This receiver also carries within its casing an open-space protector. Each terminal carries a lug, with a machine screw through its end. The lugs and screws are so formed and placed that the two screws stand out free in parallel position, with a fractional clearance between their adjacent thread surfaces.



SULLIVAN TELEPHONE RECEIVER.

Mr. C. E. Williams, of Natick, Mass., is the inventor of the second transmitter. The microphone bottom is held to the inside of the front cover of a closed cylindrical box. Mounted upon the front of this box is a bowl-shaped resonating chamber of smaller diameter than the box. A circular row of holes just without the bowl leads through the box cover to admit sound to the box. A second row of holes through the box cover leads into the resonating bowl. Bowls of different shapes may be used, each designed to reinforce those sounds most necessary for the peculiarities of hearing of the particular user.

A head receiver attachment forms the subject of a patent issued to W. E. Peters, of Athens, Ohio, designed to relieve the physically uncomfortable pressure upon the ear of the user. This comprises a ring adapted to replace the usual ear-cap. It carries a perforated diaphragm so as to maintain the shallow, plate-like air chamber next to the diaphragm. The front edge of the ring carries a suitable facing piece. In use the ear of the user is placed completely within the ring, the facing being in contact with the head and face of the wearer, the ear having no direct pressure contact.

NEW CIRCUITS AND APPARATUS.

Most common-battery circuits are so designed that the tip contact serves upon proper occasion for both testing contact and talking circuit. In a circuit system patented by H. C. Goldrick, of Indianapolis, the tip contact is relieved of one of these functions and is used exclusively for test. The jack is so arranged that when a plug is shoved home, the tip stands clear and an auxiliary contact serves to charge the jack test ring. The plug and cord are, of course, of the three-strand type, the ring and sleeve being the talking circuit.

Another patent is that granted to C. S. Winston, of Chicago, and covering a circuit designed to throw a clearing-out drop in response to the movement of a distant subscriber's hook switch. For example, where a magneto cord pair is used to connect a magneto subscriber, or a toll line, to a common-battery subscriber over a trunk, the present circuit is so arranged that the hanging up of the receiver by the common-battery subscriber causes a current through the clearing-out drop at the distant cord pair.

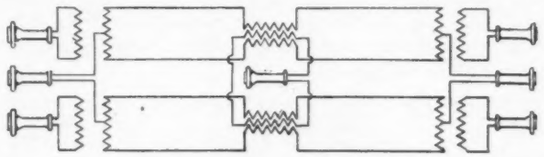
Mr. C. H. Smith, of Chicago, has patented a new design of jacks of the individually mounted variety. The jack frame is bent up so as to form a brace piece on each side of the springs. The ends of these pieces are turned over toward each other, perforated and threaded in line. A thimble screws from the front of the switchboard thereby engaging and clamping the jack. The bore of the thimble has a small key-way to engage a boss on the wrench. This same inventor has also obtained a patent for an indicating key of the multiple-plunger party-ringing type. The indicators are disks in the key-face, each associated with its own plunger. A line is ruled across each disk. When a plunger is depressed, a pin riding on a cam on the disk spindle rotates the latter and shows the ruled line turned through 180 deg. The disks return to normal upon the next depression of a different plunger from that indicated. Both of the above patents have been assigned to the Kellogg Switchboard & Supply Company.

A push-plate, locking-type, intercommunicating gang switch is the invention of H. C. Thomson, his patent being assigned to the Electric Goods Manufacturing Company, of Boston. The hook switch-lever acts with the locking plate to render the operation of the key system as nearly automatic as possible.

PHANTOM CIRCUIT.

The so-called "phantom circuit" has come into very general use in the last few years. This circuit is formed by the use of two physical or all-wire metallic circuits in such a manner that each of these circuits serves as one limb of the superimposed or phantom circuit, the two metallic physical circuits thereby serving for three telephone circuits for simultaneous non-interfering use. The phantoming is accomplished usually by the means of repeating coils, the inductive relations of the various fractional windings of these coils serving to identify the various currents and keep them distinct. With the usual system, when there is an intermediate station, each physical line must be broken by the insertion of phantom repeating coils at the intermediate station. It will thus be seen that, while telephonically the physical circuits are continuous, yet conductively they are not so.

A patent recently granted to Mr. H. B. Stone, of Providence, R. I., describes a method of connecting in an intermediate station in such a way that the physical circuits are continuous conductively. The accompanying illustration shows diagrammatically such an improved circuit. It will be noted that the intermediate station is connected to the physical circuits inductively only. It will be seen that telephone currents upon the physical circuits, traversing the two limbs of the physical line, act differentialy upon the tertiary of the intermediate station repeating coil and, therefore, they are not effective in the telephone instrument at that station. For the phantom, however, the telephone currents generated in the phantom station traverse the two physical circuits. These currents reach the physical circuits at the middle points of the two terminal repeating coils, the two windings of which are differential with regard to these currents. It will be seen that both limbs of a physical circuit in parallel serve as one limb of the phantom. Therefore, the currents traversing one of the physical circuits



STONE PHANTOM CIRCUIT.

become cumulative at the intermediate repeating coil and, hence, become effective at the intermediate station. At the distant station, at the far end of the physical circuit, the phantom currents are effective at the phantom station in the usual manner.

Letters to the Editors.

Auto-Transformers vs. Rheostats for Induction-Motor Starters.

To the Editors of Electrical World:

Sirs:—The article in your issue of Feb. 25, by Mr. I. E. Hanssen, on "Auto-Transformers vs. Rheostats for Induction Motor Starters," is very interesting; the title, however, may be somewhat misleading to the casual reader, as "starting induction motors by rheostat" usually is understood to mean the starting by a rheostat in the secondary circuit, with the full voltage impressed upon the primary circuit. The above article, however, refers to the use of a rheostat in the primary circuit of the induction motor, which, as is well known, acts entirely differently from a rheostat in the secondary. The method discussed in the above article corresponds to the starting of a direct-current shunt motor, with the armature permanently connected in shunt with the field circuit and a starting rheostat in series with the field and armature circuits; in this case, in starting the field circuit gets very little voltage, and the starting efficiency therefore is extremely low. The usual method of starting induction motors by secondary rheostat corresponds to the starting of a direct-current shunt motor with full voltage on the field circuit and a rheostat in the armature circuit—that is, the method giving the highest starting efficiency.

While the above-mentioned article shows the auto-transformer, or auto-starter, method as superior to the use of a rheostat in the primary circuit, it must not be overlooked that even the auto-starter remains very much less efficient in starting than the use of the rheostat in the secondary, and for a complete comparison the values given by the latter method should be added. While the constants of the two motors referred to in the article are not given, still a fairly accurate estimation of the performance of the motors when starting at full-load torque by an armature rheostat can be made.

As is well known, inserting a non-inductive resistance in the secondary circuit of an induction motor reduces its speed, at the same torque, but does not change the current or power factor; and the current, power factor, power input, etc., of a motor when starting at full-load torque with a secondary rheostat are therefore the same as those of the same motor when running at full load and full speed.

With a 30-hp, 25-cycle motor the efficiency and the power factor at full load probably will be approximately 90 per cent. That is, with an output of 30 hp = 22.5 kw, the power input is $22.5 \div 0.9 = 25$ kw, and the kva input is $25 \div 0.9 = 27.8$ kva. Such a motor in starting at full-load torque with a secondary rheostat therefore consumes 25 kw and 27.8 kva—that is, a current of 40 amp per line; and the comparison of Table I of above article when completed by inserting the starting constants of the armature are thus:

STARTING TORQUE EQUALS FULL-LOAD RUNNING TORQUE.

	Motor No. 1			Motor No. 2		
Type of Starter.	Amp. in line.	Kva. in line.	Kw. in line.	Amp. in line.	Kva. in line.	Kw. in line.
Auto transformer*	101	70	33	133	92	33.5
Primary rheostat*	158	110	91.6	158	110	72.5
Secondary rheostat	40	27.8	25	40	27.8	25
Values: Primary rheo. / Auto-starter*	1.57	1.57	2.77	1.18	1.18	2.16
Values: Auto-starter / Secondary rheo.	2.52	2.52	1.32	3.32	3.32	1.34

The difference between auto-starter and secondary rheostat is startling. While the auto-transformer starter consumes less current and less kilovolt amperes than the primary rheostat starter, the former requires from 2½ to 3⅓ times as much current to start with full-load torque than the method of starting by a secondary rheostat; it is thus much inoperative; and where frequent starting under heavy load is required and any objection exists against the sudden consumption of excessive currents, the secondary rheostat is the preferable method of starting, though the auto-transformer has the advantage of permitting a squirrel-cage armature structure, and therefore, owing to the extreme simplicity of the construction of the induction motor proper, this method is preferable wherever it is permissible—that is, where the motor can be started at light load, or has only infrequently to start under heavy load. Where starting and acceleration under heavy load and with moderate volt-ampere consumption are of importance, as in railway service, obviously the only feasible method is the use of the rheostat in the secondary circuit.

Schenectady, N. Y. Charles P. Steinmetz.

*Taken from above-mentioned article.

The Luminous Efficiency of Metal-Filament Lamps.

To the Editors of Electrical World:

Sirs:—In the very interesting paper by Dr. Coblentz on "The Luminous Efficiency of Metal-Filament Lamps," which was published in your issue of Dec. 18 but which has just come to my notice, there is one point to which I should like to call further attention.

The curves given in Fig. 2, on page 1345 of the above issue, show, according to the author, "the distribution of energy flow in the spectra of a filament of flashed carbon and of tungsten, set to the same emissivity in the visible spectrum."

It would seem to me, however, that this statement does not give an entirely accurate idea of the conditions of the experiment or of the full significance of the results. Since the bolometric measurements in this experiment were kindly made by Dr. Coblentz at my request and under conditions which I had carefully specified in order to obtain a direct confirmation of conclusions which had been reached by other methods,[1] I feel that a few further explanatory remarks might not be out of place.

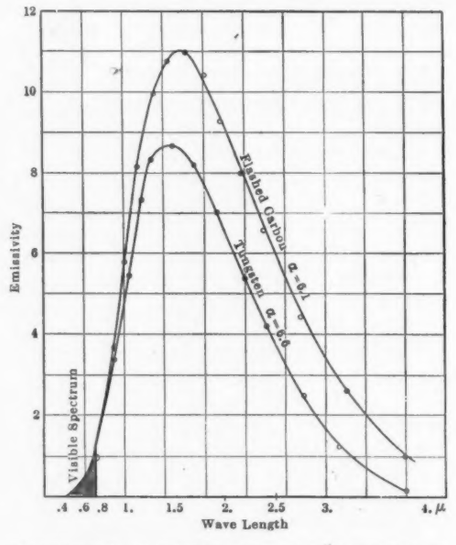


FIG. 2.—DISTRIBUTION OF ENERGY FLOW IN THE SPECTRA OF FLASHED CARBON AND TUNGSTEN. (REPRODUCED.)

The curves given in Fig. 2 were obtained on the flashed carbon and osmium filaments when operating at voltages at which the two filaments show the same distribution of energy in the

[1] Hyde, "New Photometric Methods of Studying the Radiating Properties of Various Substances." Paper read before the Amer. Phys. Soc. Oct. 24, 1908. See *Abstract*, Phys. Rev., Vol. 27, No. 6, page 521, December, 1908.

visible spectrum as another flashed carbon lamp taken as an arbitrary standard. According to the measurements made by Cady, Middlekauff and myself,[1] the lumens per watt of the osmium lamp under these conditions were very much greater than the corresponding value for the flashed carbon, indicating that the infra-red spectrum of the osmium filament is greatly suppressed as compared with that of the flashed carbon. In order to obtain a further check on this conclusion, Dr. Coblentz kindly undertook to measure for us the emission in the infra-red at the voltages which we had determined as giving the same distribution of energy in the visible spectrum—i.e., the same color. These measurements, which extended into the red end of the visible spectrum, were plotted to such scales that the ordinate in the red is the same for the two. According to our measurements the ordinates are, therefore, the same throughout the visible spectrum. The suppression of the infra-red spectrum of the osmium is shown clearly, and the numerical value of the ratio of the two areas enclosed between the respective curves and the axis of abscissas is the same to within observational error as that which we had previously obtained by the other method. (See papers before referred to.)

From this viewpoint the chief significance of the curves in Fig. 2 in Dr. Coblentz's paper lies in the illustration which they afford of the applicability of the new photometric methods of obtaining a positive qualitative criterion of "selectivity" by studying the properties of the radiating filaments under the conditions of the same distribution of energy in the visible spectrum. The question of the relative temperatures of filaments under this condition is discussed in the papers to which reference has been made.

CLEVELAND, OHIO. EDW. P. HYDE.

[1] Hyde, Cady and Middlekauff, "Selective Emission of Incandescent Lamps as Determined by New Photometric Methods." Paper read before the New York Section of the Illuminating Engineering Society, Feb. 11, 1909, printed in abstract in *Electrical World*, Vol. 53, No. 8, page 439, Feb. 18, 1909. To be printed in full shortly in the *Transactions* of the Illuminating Engineering Society.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Ventilation of Laminated Iron Cores.—A note on a recent British patent (8,997, 1908; Feb. 11, 1909). Ventilating by means of ducts in the plane of the laminations is not always effective on account of the varnish or paper insulation. In the case of the cores of transformers and the poles of single-phase commutator motors where the magnetic field is alternating and not rotary, the ventilation is effected, according to this invention, by slots transverse to the laminations. These slots must be in the direction taken by the main flux, and must be narrow. They can extend the full length of the magnetic circuit. Connecting cross-pieces can be left, or the core can be made up of parts spaced by distance-pieces.—Lond. *Elec. Eng'ing*, Feb. 18.

Turbo-Alternator.—A. KOLBEN.—The conclusion of his illustrated description of 3200-kva, three-phase generator directly coupled to a steam turbine. With unity power factor at a speed of 900 r.p.m. the efficiency is 96 per cent.—*Elek. Zeit.*, Feb. 18.

Lamps and Lighting.

Luminous Efficiency and Mechanical Equivalent of Light.—C. V. DRYSDALE.—An abstract of a paper read before the Physical Society of London. On the basis of Wien's law it is possible to calculate the energy radiated between any two wave-lengths—for instance, between the limits of the visible and compare it with the total radiation. The author has calculated the ratio of "luminous" to total radiation and the "luminous efficiency" for various temperatures. The comparison of the luminous energy so calculated with the intensity of light radiation found by Professor Fery leads to a mechanical equivalent of light of about 0.075 watt per candle, which is a fairly probable figure. The results show the enormous extent to which the luminous efficiency is dependent upon the temperature and how extremely low it is at ordinary temperatures. At 1500 deg. C. the efficiency is of the order of 1 per cent, or less, while at 2000 deg. C. it is about 3 per cent. The highest efficiency is obtained at a temperature of about 6500 deg. C., and is then only between 40 per cent and 50 per cent. This fact strongly points to the necessity for working in the direction of selective radiation or luminescence. In the discussion the opinion was expressed that the physiological effect on the eye should be taken into account in speaking of or defining "luminous efficiency." The author replied that there are three modes of defining it, of which two were due to Professor Nichols, of Cornell, who distinguished between "total efficiency" and "radiant efficiency." The former of these quantities is the ratio of the luminous energy radiated between the spectral limits to the total energy of consumption of the source of light, and the latter the ratio of the luminous energy as above to the total radiation from the source. However, neither of these definitions takes any cognizance of the very different luminosities of the various spectral colors, and this had been realized by Dr. C. Guilleaume, who proposed to correct the luminous radiation by multiplying each ordinate of the radiation curve by a factor depending on the luminosity at that ordinate which is unity at the point of maximum effectiveness (0.54 μ). The author had proposed the term "reduced" total or radiant efficiency for the efficiency expressed on this basis, and this is evidently the most rational one.—Lond. *Electrician*, Feb. 19.

Flame Arc Lamps.—An illustrated description of two new flame arc lamps, the "Prima" and "Rebofa," made by an English company. The first-named is of the usual converging-electrode pattern, but in the Rebofa lamp, which has only recently been introduced, the electrodes are arranged vertically above each other. Both lamps are provided with gravity feed mechanisms, and with the usual shunt and series solenoid control of the arc. The Rebofa lamp with vertically arranged electrodes is illustrated in Fig. 1. The two electrodes are con-

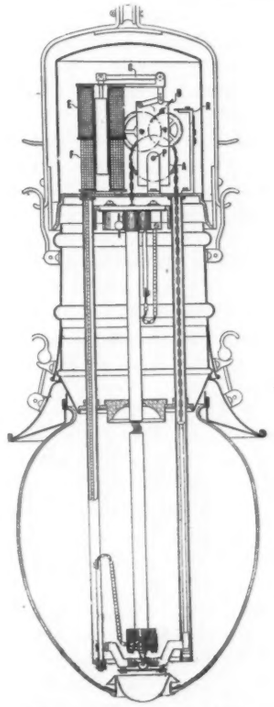


FIG. 1.—"REBOFA" LAMP.

nected by a chain passing over the sprocket wheel *A*, which is geared to a train of wheels ending in a fan wheel *B*. The clockwork is pivoted on the axle *P* of the sprocket wheel, and the lever *C* of the regulating gear is connected by a system of smaller levers to the clockwork frame. When the arc lengthens the pressure increases and the shunt solenoid *E* lifts the plunger and thus rocks the clockwork frame to the left. This action brings the two electrodes a little nearer together. As they burn away, the clockwork is rocked still more to the left, and finally the fan wheel *B* is brought out of contact with the fixed catch *R*. The mechanism is thus released, and feeding takes place until the series coil, by drawing down the plunger, again causes the fan wheel to be locked. An interesting point in connection with the air dash-pot provided is that the piston is made of graphite, thus avoiding any tendency for it to stick. The arc in this lamp is very short; the variation in the length of the arc is also very small. Feeding takes place at very frequent intervals, but the electrodes are moved together only a very small amount at each feed. The "economizer" is of fire-clay, supported, as shown, by a cast-iron ring. No "blow" is necessary in this pattern of lamp. The electrodes used are of special manufacture, with large impregnated cores surrounded by a comparatively thin shell of pure carbon, and owing to the disposition of the electrodes the arc burns steadily from the cores, having no tendency to burn from the hard carbon shell. The light is stated to be of a soft white color, suitable for color matching. Electrodes giving a yellow light can be used if required. Six of these lamps can be run on a 200-volt circuit. A 34-in., 12-amp lamp burns 18 hours on one pair of electrodes, and a 40-in., 12-amp lamp about 25 hours. The 40-in. lamp, when provided with 8-amp carbons, burns 22 hours. The chief advantage claimed for this type of lamp is that a greater distribution of light in a horizontal direction is obtained than with the converging-electrode flame lamps, thus rendering the lamp particularly suitable for the lighting of streets and other open spaces.—Lond. *Elec. Eng'ing,* Feb. 18.

Flame Arc Lamp.—A note on a recent British patent (1596, 1908; Feb. 11, 1909) of H. E. Moul. In flame arc lamps with converging electrodes the ash is sometimes deposited on the tips of the electrodes, thereby preventing the arc from being struck after it has been extinguished. The present invention is for a feeding mechanism in which the electrodes are fed down alternately instead of simultaneously, so that a rubbing action is produced between the fixed and the moving electrodes to scrape off any deposit. This alternate feed is effected by supporting the two electrodes by chains which pass round two slotted pulleys threaded loose on the same spindle and provided with ratchet wheels. Fixed pawls prevent the backward rotation of these wheels, and the forward movement, which is in opposite directions for the two wheels, is caused by two pawls on a rocking lever. This lever is rocked by the series coil, which is in circuit only when feeding is necessary, but then gives the rocking motion continuously, as the plunger short-circuits the coil when it rises, and thus works up and down continuously. A shunt coil controls one electrode by means of a sliding collar in the usual manner. When the plunger of the shunt coil has risen to its full amount, it opens the short-circuiting switch of the series coil and allows the latter to operate the feeding mechanism until the arc has attained its normal length. A "blow" magnet to control the arc is provided; this is arranged to insert a substantial resistance when the arc is extinguished. —Lond. *Elec. Eng'ing,* Feb. 18.

Flame Arc Lamps.—A note on a recent British patent (17,421, 1908; Feb. 11, 1909) of Koerting & Mathiesen, A. G., for ventilation of arc lamps. In arc lamps with "economizers" the vapors, instead of rising upward, move laterally and cause a deposit to be formed on the cold globe. To prevent this action the "economizer" is, according to this invention, surrounded by a cylindrical transparent chimney, and the vapors pass upward through the annular space between the neck of the chimney and the economizer. Air enters at the bottom of the main globe, which is closed at the top, and rushes through the inner chimney, taking with it the vapors. The chimney is quickly heated, and is prevented from cooling by the body of air between it and the outer globe.—Lond. *Elec. Eng'ing,* Feb. 18.

Comparison of Incandescent Lamps.—C. Leonard.—The conclusion of his illustrated article on the comparison of carbon lamps with the recent high-efficiency incandescent lamps. The author shows how to find by means of a graphical method the minimum cost of the cp-hour if the cost of the kw-hour and the cost of the lamp are given. If the energy costs 14 cents per kw-hour and the carbon lamp costs 8 cents, he finds that the minimum possible cost of the cp-hour is 0.05 cent. This corresponds to a specific consumption of 3.3 watts per mean spherical candle-power during the useful life of the lamp or to 2.3 watts per mean horizontal candle-power at the start. Under these conditions the carbon lamp is "rationally utilized." He then gives the following figures on recent lamps: Cp means bougies or hefner cp (1 hefner cp = 0.88 British cp).

	Volts.	Mean horizontal cp.	Mean spherical cp at start.	Watts per mean horizontal cp at start.	Watts per mean spherical cp during useful life.	Useful life in hours.	Price, francs.
Graphitized carbon lamp.	110	16	12.8	2.5	3.4	500	0.40
Nernst lamp.....	220	31	18.9	1.8	3.25	300	1.70
Tantalum lamp.....	110	22	16.7	2.0	2.6	800	3.00
Osmium lamp.....	40	25	18.5	1.5	2.40	800	5.00
Tungsten lamp.....	110	22	16.3	1.25	1.9	800	3.75

Fig. 2 gives the curves of the cost of the cp-hour for different lamps. For different prices of electrical energy the abscissas give the price of the kw-hour in francs (1 franc = 20 cents). The ordinates give the price of the cp-hour in centimes (5 centimes = 1 cent). Curve I refers to the carbon lamp "rationally utilized"; curve II, to the carbon lamp at 3.5 watts per candle-power; curve III to the graphitized filament lamp at 2.5 watts per candle-power; curve IV to the graphitized filament lamp, "rationally utilized"; curve V to the Nernst lamp; curve VI to the tantalum; curve VII to the osmium, and curve VIII to the tungsten lamp.—*La Lumière Elec.,* Feb. 13.

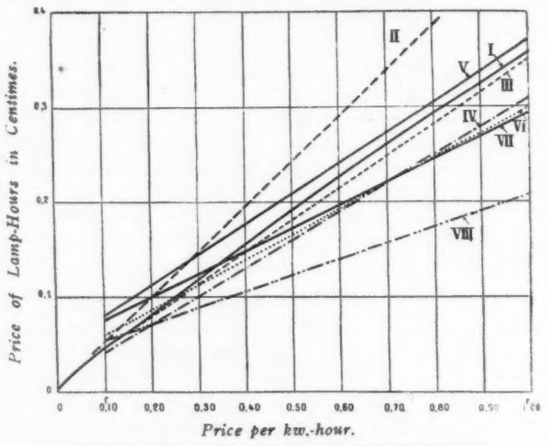


FIG. 2.—COMPARISON OF INCANDESCENT LAMPS.

Metallic-Filament Lamps.—A note on a recent British patent (2707, 1908; Feb. 11, 1909) of J. Howard. In the process of manufacturing metallic-filament lamps, after the filament has been mounted for the bulb exhausted, it is necessary to pass a much larger current than the normal working current through the filament in order to expel the absorbed gases. With high-voltage lamps, as, for example, a 250-volt lamp, a pressure of 350 volts may be necessary for this purpose, and it has been found that a discharge, which is detrimental to both the filaments and the vacuum, takes place between the filaments at the extreme ends. According to the present invention, when the filament consists of several loops in series, auxiliary leading-in wires are fitted solely for the purpose of running the lamps with the loops temporarily in parallel. A low pressure can then be used for the above operation, and there is no discharge. Lond. *Elec. Eng'ing,* Feb. 18.

Electric Lighting.—L. Gaster.—A paper read before the

Royal Society of Arts in London. The author emphasized the importance of efficient illumination as a means of preserving the eyesight, and referred to the possible dangers from ultra-violet rays. The need of co-operation between the lamp manufacturers and central-station authorities for the purpose of protecting the consumer from vendors of inferior over-run lamps was insisted upon.—Lond. *Elec. Eng'ing*, Feb. 18.

Uniform Illumination.—E. W. WEINBEER.—A third article on methods for obtaining a uniform illumination of a surface or a space. In the present article the author deals with the geometrical configuration of bodies giving out light.—*Zeit. f. Beleuch.*, Jan. 30.

Generation, Transmission and Distribution.

Steam-Turbine Efficiency.—Criticism is first made of a statement which has been often repeated to the effect that "the possible efficiency of a Parsons turbine decreases when the number of stages is increased, because the area exposed to fluid friction is greater the greater the number of stages." It is shown that this statement is fundamentally wrong from both a hydraulic and a thermodynamic point of view. The possible efficiency of the reaction type of steam turbine is considerably greater than that of the impulse type. In the former the losses per stage are due to the friction and shock at one row of blades only, while in each stage on the impulse type losses due to friction and shock at two rows at least are included. In actual

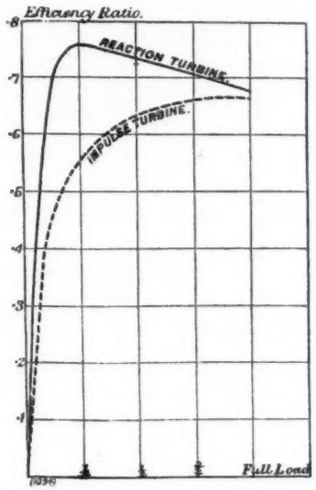


FIG. 3.—STEAM TURBINE EFFICIENCY.

commercial practice there is, however, no great difference between the best recorded efficiency ratios of the two classes. This result is due to two reasons: In the first place the reaction type suffers more from leakage losses than its rival; secondly, to reduce its first cost it is commonly run at full load at a much smaller fraction of its synchronous speed than is the impulse type. The shape of the efficiency curve is compared for the two types as the load falls off. The curves given in Fig. 3 are from actual practice, the reaction turbine being a 2000-kw electric lighting unit, while the other is an impulse turbine of a well-known make and style. It is a much smaller machine than the reaction turbine with which it is compared, so that it would be unfair to compare the absolute efficiencies of the two. The difference in the character of the curves is, however, very instructive. Both turbines were governed by throttling; the efficiency is reckoned from the state of the steam in front of the first set of guide-blades, while generator losses have been allowed for. Apparently at full load the impulse turbine was just a little under-speeded, and as the average speed of the steam through the turbine is reduced by throttling down, the efficiency slightly increases at first until the output is about seven-eighths of the full load; afterward it steadily diminishes, the blade speed being too great for the reduced steam speed. With the reaction turbine, on the other hand, as the average speed of the steam throughout the turbine is reduced by throttling, the efficiency ratio continuously increases until the load is reduced to about a quarter of the maximum, although it seems certain that for some time before this point is reached the low-pressure groups of the blading have already passed through their point of maximum efficiency. At still lower loads negative work begins to be done at the low-pressure end, and the efficiency falls rapidly to zero. The two curves in the diagram show that the reaction type is very much under-speeded at full load, but so high is its inherent efficiency that it can afford to give its competitor the advantage of running at synchronism, and yet equal its fuel consumption per kw-hour. —Lond. *Engineering*, Feb. 19.

Gas Engines.—B. HOPKINSON.—An abstract of a paper on heat-flow and temperature distribution in the gas engine. In the course of the expansion and the exhaust strokes of the gas engine, from a quarter to a half of the whole heat developed in the explosion is discharged into the cylinder walls. This flow of heat has little effect on the efficiency, but is important inasmuch as it necessitates the provision of special cooling appliances to carry it away, and it also requires the existence of a temperature gradient sufficient to carry it from the place where it is generated to the place where it is removed. High temperatures must exist in the uncooled parts of the engine, and great temperature differences must be between one part and another. These conditions give rise to dangers from pre-ignition, and also to severe mechanical stresses in the metal, which between them account for a large part of the practical difficulties encountered in running large gas engines. The calculations of the author lead to the conclusion that the temperature on the inner surface of portions of the engine which are efficiently cooled, such as the liner, can never rise above quite a moderate value, but the temperatures at the center of an uncooled piston may reach 400 deg. C. or more. Experiments showed that the rate of heat flow into the face of the piston is about one-eighth of the total flow in the engine. Of the fall of temperature between the center of the piston and the water-jacket about one-half, say, 180 deg. C., is between the center and edge of the piston face. In consequence of this inequality of temperature there is a considerable hoop tension at the edge of the piston face, which probably amounts to several tons per square inch. Uncooled pistons of large diameter will be likely to fail by a radial crack at the edge, which in many cases may be followed by seizing of the piston on account of the sudden expansion which is thus permitted. Investigations were made as to the effect upon the metal temperature of varying the conditions of running. If the gas charge be increased by 30 per cent the total heat loss will be increased by 50 per cent, with a corresponding increase in the temperatures of the piston and the inlet valve. Retarding the ignition by 20 per cent reduces the heat loss by 10 per cent. The piston and inlet valve are then cooler, but the exhaust valve temperature is not materially affected. Thermal efficiency is reduced from 34½ per cent to 28½ per cent. Advancing the ignition by 10 per cent has little effect on the efficiency, but increases the heat by 10 per cent. Some interesting experiments were made on the phenomena of pre-ignition. In order to cause the engine to pre-ignite, an iron bolt carrying a thermo-couple at its end was introduced into the combustion chamber. The temperature of the end of the bolt heated by the explosions rose to 700 deg. C. without in any way affecting the working of the engine, but when the temperature exceeded 730 deg. C. ignitions took place from the end of the bolt. Since the effect of these ignitions is to heat the end of the bolt still further, they thus tend to propagate themselves and to become more frequent. If they once start, the engine is bound to come to rest.—Lond. *Elec. Times*, Feb. 11.

Steam Turbines vs. Gas Engines.—A paper read by Leonard Andrews and Reginald Porter before the (British) Inst. Elec. Eng. started a discussion on steam turbines versus gas engines for electric power houses. The authors of the paper have estimated the costs for a large generating station alternatively with steam and gas plant, and have arrived at the conclusion that with the price of coal above a certain figure, and with a sufficiently high load-factor a gas plant is more economical either

than a steam plant or than a combination of steam and gas engines. The figures are worked out in considerable detail. In the discussion W. B. Woodhouse and E. J. Fox championed the cause of the steam turbine, giving reasons for disputing the applicability of the authors' estimates without considerable modification. Fox particularly laid stress on the flexibility of the turbine plant for meeting the peculiar demands of an electricity supply load. Percy R. Allen, of the Castner-Kellner Alkali Company, gave an account of his favorable experience with a gas plant in a large generating station.—Lond. *Electrician,* Feb. 12 and 19; *Elec. Eng'ing,* Feb. 18.

Electric Driving in Factories.—H. B. Poynder.—After giving some notes on the rating of three-phase motors, the author points out the various difficulties that are encountered in the electric driving of different kinds of machinery, and shows how these difficulties have been overcome. In the case of printing and paper-making machinery, he advocates the use of the Ward Leonard system in preference to direct drive by three-phase motors, and explains a system suitable for the driving of calico-printing machines, in which the energy is distributed to the motors by means of a five-wire direct-current system, the motor armature being supplied with energy at nine different pressures in order to obtain the varying speeds necessary.—Lond. *Elec. Eng'ing,* Feb. 18.

Electro-hydraulic Pumping Plant.—W. A. Clatworthy.—An illustrated description of the electro-hydraulic pumping plant at the Bristol docks. This plant, which possesses several novel features, particularly in the method of electrical control, provides water power for operating various cranes, capstans, lock-gates, bridges, etc., in connection with the Bristol docks. Steam pumps, which were previously used, have been replaced by three sets of electric pumps.—Lond. *Electrician,* Feb. 19.

Small Motors.—W. Sughe.—An illustrated article in which the author shows how the small electric motor with a rating of from 0.5 to 5.0 hp is advantageous not only for central stations, but for the farmer and for small workshops. A number of examples are given to show the central-station engineers how to explain these advantages to their customers.—*Elek. Zeit.,* Feb. 18.

Gas Turbine.—M. Armengaud.—The first part of an article in which the author gives the calculation of a gas turbine in order to show that the fuel consumption would not be prohibitive.—*La Lumière Elec.,* Feb. 13.

Steam Turbine.—J. W. Kirkland.—An illustrated description of the Curtis steam turbine as built by the General Electric Company.—*Gen. Elec. Rev.,* March.

Scale and Corrosion of Boilers.—J. C. W. Greth.—A paper read before the Amer. Inst. Cem. Eng., pointing out the general characteristics of those substances which cause the scale and corrosion in boilers, and making suggestions on the softening and purifying of boiler water.—*Power,* March 2.

Traction.

Electric Ferryboat.—O. Reich.—The first part of an illustrated description of the equipment of an electric ferryboat crossing the River Rhine between Godesberg and Niederdollendorf. It is a double-screw boat and has a battery of 160 cells with a rating of 335 amp-hours for a one-hour discharge. Each of the two propellers is driven by a 300-volt, 50-hp direct-current series motor. The motors have interpoles so as to permit the regulation of the speed within wide limits and also sudden reversals without sparking at the commutator. The motors are started and regulated from the pilot house.—*Elek. Zeit.,* Feb. 18.

Installations, Systems and Appliances.

"Rotary Condensers" in Steel Mills.—A. L. Jones.—The induction motor is exceedingly well suited for steel mills, but requires an excess of magnetizing current. In planning an installation of generators for supplying energy to an induction-motor load one is confronted with the necessity of taking care of the idle current either by extra generator capacity or by supplying the wattless magnetizing current from over-excited synchronous motors; which of the methods is to be preferred depends on circumstances. If the generators are of slow speed, and hence are very large for their output, it will probably be cheaper to put in a high-speed rotary condenser. If the load is at the end of a long feeder or transmission line, a condenser installed near the motors would probably be the better arrangement, as this would save circulation of idle current through the transmission line and generator. The gain in power factor of the generator, however, is not proportional to the amount of leading current supplied. In general, no attempt should be made to raise the power factor above 96 per cent, since any further increase requires an amount of leading current out of all proportion to the improvement of power factor or generator capacity reclaimed. An over-excited synchronous motor used to supply magnetizing current for induction motors can also carry some mechanical load. With certain mechanical loads a larger proportion of leading current is available than with other loads. With the motor driving a mechanical load of 71 per cent of its rated capacity and with the field over-excited to give full current, 71 per cent of its rating is available as magnetizing current. This proportion is the most advantageous one.—*Gen. Elec. Rev.,* March.

Automatic Circuit Breakers.—C. C. Garrard.—An illustrated article on trip coils for alternating-current automatic circuit breakers. The author gives experimental results showing how the trip coil of a group feeder may, under certain conditions, be operated, owing to the momentum of the moving parts, when the circumstances are such that only one of the feeder trip coils should have come into operation. Continuous-current trip coils are generally used on alternating-current systems. The author considers whether it is not desirable to eliminate this continuous current in many cases and to work entirely with alternating-current coils. He discusses the maximum circuit breaker, reverse-power circuit breaker, and reverse relays combined with no-voltage circuit breakers.—Lond. *Electrician,* Jan. 9.

Wires, Wiring and Conduits.

Underground Cables.—J. R. Dick.—A continuation of his long serial on the design of underground mains and networks. In this section of the article the author discusses Kelvin's law for the best cross-section of cables. In practice, considerations of temperature rise obviate the necessity of elaborate calculations. Boosted and unboosted feeders, split feeders and equalizing mains are also discussed, as well as practical considerations affecting the position of feeding points.—Lond. *Electrician,* Feb. 19.

Connection Between Conduit and Overhead Lines.—An illustrated description of the system of through-running between the conduit and overhead systems on the London County Council tramways. Special arrangements for removing and reinserting the contact plows of the cars of the London County Council's tramways are provided at the ends of the Camberwell and Brixton section.—Lond. *Elec. Eng'ing,* Feb. 4.

Electrophysics and Magnetism.

Doppler Effect in Positive Rays.—J. Trowbridge.—Goldstein discovered canal rays and the Doppler effect in these rays. It is now known that in addition to the positive rays behind the cathode—the canal rays—there are retrograde positive rays which are directed to the anode, or rather away from the cathode in the direction of the anode. This latter discovery leads one to expect that the Doppler effect is to be found also between the anode and the cathode. The result of the present author's study shows that the effect does exist in this region and indicates a movement away from the cathode and toward the anode.—*Am. Jour. of Science,* March.

Atmospheric Electricity.—P. H. Dike.—A summary of various recent observations in atmospheric electricity.—*Am. Jour. of Science,* March.

Thermodynamics.—C. P. Steinmetz.—A continuation of his mathematical serial; the author now takes up in detail the thermodynamics of gases.—*Gen. Elec. Rev.,* March.

Electrochemistry and Batteries.

Electric Steel Refining.—R. Amberg.—An article on deoxidation and desulphurization in electric steel furnaces. The prin-

cipal reaction in the removal of sulphur is the formation of calcium sulphide. In the Héroult furnace simply lime is used and calcium carbide forms in the furnace. In the induction furnace ferosilicon is added.—*Electrochem. and Met. Ind.*, March.

Electric Steel.—J. A. SEEDE.—An illustrated article reviewing the different electric furnaces for the refining of steel and the reduction of iron ore. The reaction by which sulphur is removed from steel is discussed and finally the possibilities of making steel directly from iron ore are referred to.—*Gen. Elec. Rev.*, March.

Steel Direct from Iron Ore.—E. STASSANO.—Some notes on the possibility of producing forgeable iron and steel directly from iron ore in a single operation in an electric furnace. He adds some critical remarks on the Lash process.—*Electrochem. and Met. Ind.*, March.

Electrolytic Refining of Precious Metals.—H. LACROIX.—An illustrated description of an electrolytic apparatus for refining silver, gold, etc. The special advantages are that the process is continuous and that there is always uniform density all over the surface of the electrodes.—*Electrochem. and Met. Ind.*, March.

Water Decomposition by Alternating Current.—M. U. SCHOOP.—By decomposing water by means of alternating current there is produced a mixture of oxygen and hydrogen gases which is directly suitable for welding with the oxy-hydrogen flame. A suitable apparatus for making oxy-hydrogen gas for welding is described. It is finally mentioned that at present there is a possibility of making hydrogen gas by decomposition of water with aluminum, on account of the present low price of the latter metal.—*Electrochem. and Met. Ind.*, March.

Electrolytic Meter.—A. FIEREZ.—A description of the Krumer electrolytic meter shown in Fig. 4. *F* and *G* are the two electrodes in helical form, one within the other and separated from each other by pieces of hard rubber. The current decomposes the water, the gases developed escape through the water seal at the top and the level of the water in the tube *B* indicates the number of amp-hours which have passed. The water seal at the top acts as follows: When the pressure within the apparatus is somewhat above atmospheric pressure, the gases enter through the holes *P* and *Q* and bubble upward through the water and leave through *C*.—*Bull. de la Soc. Belge des Elec.*, January, 1909; *La Lumière Elec.*, Feb. 13.

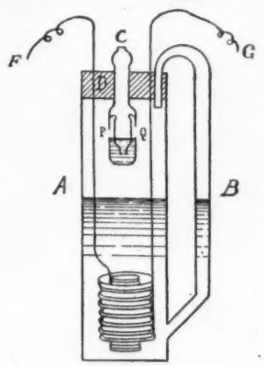


FIG. 4.—ELECTROLYTIC METER.

Thermoelectric Pyrometers.—C. H. WILSON.—Both the low-resistance thermoelectric pyrometer and the high-resistance thermoelectric pyrometer are capable of accuracy, but the mistake of uniting the thermocouple of the latter with the indicator of the former should not be made. If one indicator is needed on both platinum and base metal couples it must be an indicator having a resistance of not less than 50 ohms.—*Electrochem. and Met. Ind.*, March.

High-Frequency Apparatus for Medical Purposes.—F. DESSAUER.—For the production of high-frequency currents for various medical purposes the arrangement shown in Fig. 5 has been found very suitable. *A* is the secondary of an ordinary single-phase transformer, which is operated by alternating current and not by direct current, with an interrupter. *C* is a condenser and *E* is a self-induction coil. F^1 and F^2 are two spark-gaps symmetrically arranged. The lengths of each gap can be adjusted by means of the screw *G*. The use of two symmetrically arranged spark-gaps is stated to give results very much superior to the use of only one spark-gap, but this is the case only when the apparatus is operated with alternating current. For induction coils with interrupters this is not the case.—*Phys. Zeit.*, Jan. 15.

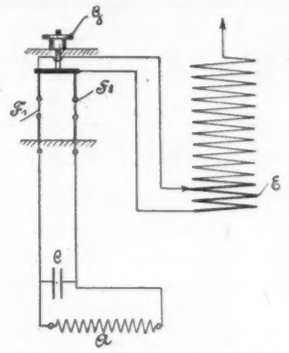


FIG. 5.—DIAGRAM OF CIRCUITS.

Selenium Cells.—C. RIES.—An article giving some notes on former work on the use of selenium vapor for the manufacture of selenium cells.—*Phys. Zeit.*, Jan. 15.

Telegraphy, Telephony and Signals.

Alternating Current for Telephony.—F. WEINBERG.—A note referring to the recent paper of A. Maior on the use of alternating current for telephony. The present author thinks that this represents the only possible solution of transatlantic cable telephony. He states that experiments have led him to the conclusion that the alternating current—a high-frequency current being used in his experiment—can easily be brought to the condition of resonance by self-inductance connected in series, and that in this way the weak undulations of the speech current can be clearly transmitted.—*Elek. Zeit.*, Feb. 18.

Automatic Telephone Exchange.—KRUCKOW.—The first part of an illustrated description of the telephone exchange of Hildesheim, which is the first automatic exchange in continental Europe.—*Elek. Zeit.*, Feb. 18.

Miscellaneous.

Method of Invention.—C. TURNBULL.—A paper in which the author points out that invention is evolutionary rather than revolutionary. He outlines a series of rules or "operators" relating to different stages in the development of invention. These are classified as follows: Selection and chain operator; equivalence operator; change of position operator; addition operator; omission and direct operator; change of proportion and increased function operator; separation operator; combination operator; transference and distribution operator; the converse or reverse operator; the constraint and freedom operator; the relay operator. What he means by his operators may be explained by "the selection and chain operator." This "works by setting forth clearly the parts on which the inventive faculty may work. In other words, the parts on which he may operate are set out like so many links in a chain, each link in turn being examined to see what can be done with it." Consider the leading-in wires of an incandescent lamp. To make them satisfactory from all points of view one may operate on the following: (1) The material of which the wire is made; (2) the shape of same; (3) constitution of the glass; (4) material or cement round the leading-in wires. A vast amount of work was done on 1, 3 and 4, but 2 was neglected until Bastian tried flattening out the wires. Then it was found that an air-tight joint could be made with flat copper wires. Probably this fact would have been discovered long ago had people only been accustomed to write down the possible parts for working on and the method of working as above.—Lond. *Elec. Eng'ing*, Feb. 18.

Underground Telegraph Cables in France.—Bazille.—At present only paper cables with air insulation are used in France. The copper conductors have from 1 mm to 2.5 mm diameter, in exceptional cases up to 5 mm; capacity from 0.06 microfarad to 0.08 microfarad per kilometer; 56, 112, 224 pairs of conductors; compressed air—2 atmospheres—is used for drying. To protect the lead covers of the cables against the stray currents from the tracks and return circuits of electric railroads, the lead cover is painted with a mixture of resin and other insulating materials.—*Elek. Zeit.*, Feb. 11.

NEW APPARATUS AND APPLIANCES

Maintenance Cost of Flaming Arcs.

By L. J. Auerbacher.

Flaming-arc lamps are now being specified by many engineers for municipalities and for industrial plant lighting and naturally the question of maintenance cost is of prime importance. Flaming-arc lamps of two distinct types are now on the market, namely, the differential lamp and the so-called gravity-feed lamp. The differential lamp is generally adjusted to operate two lamps in series on 110-volt circuits, taking 10 amp for the series; whereas the gravity-feed lamp, as a rule, is adjusted at 11 or 12 amp.

Taking the differential lamp as an example, the consumption of each lamp is 550 watts, which at an average cost of 2 cents per kw-hour makes the cost $11 per 1000 hours for current. Taking the net cost of imported flaming-arc lamp carbons, the cost per trim per 1000 hours, including labor, would be $8.50, making the total cost of trim and carbons $19.50 per 1000 hours. The cost of repairs and globes per 1000 hours may be figured at $2, to which must be added interest on the investment and a depreciation of $2 per 1000 hours, making a total of $23.50 per 1000 hours of operation. At an average yearly burning of about 4000 hours the cost per hour would be $94 per year per lamp.

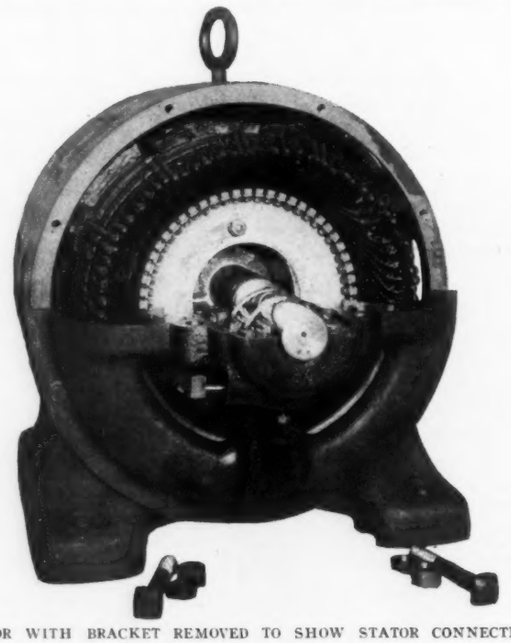
For municipal lighting, the general plan of installing these lamps is to mount two lamps on one pole, as it simplifies the wiring problem over the plan of mounting one to a pole. The height of the lamps above the sidewalk should be not less than 25 ft., so as to secure a good distribution from the high candlepower given out by these lamps. Several cities have installed these lamps with great satisfaction to the citizens, who are willing and have even initiated a scheme for paying an extra assessment per front foot in order to get the increased illumination which results. This naturally results in increased revenue to the lighting companies, not alone from the operation of the lamps themselves, but also from the fact that one brilliantly lighted thoroughfare sets the standard and other streets must soon follow the lead so as not to suffer by comparison. At the same time, private lighting is brought up to a higher standard in order to compare favorably with the standard set by the flaming-arc lamps. In other words, flaming arcs are a great stimulant to the lighting industry and should be encouraged by lighting companies for that reason, if for no other.

Induction Motors for Mill Service.

In comparison with direct-current motors for mill service the squirrel-cage induction possesses the advantage of requiring neither commutator nor sliding contact, so that it is relatively an almost indestructible machine. The only parts subject to wear are the bearings, and if these are properly constructed the motor will withstand successfully extreme service conditions. However, it is only when the motor has been designed particularly for mill service that it will exhibit the proper operating characteristics. The starting torque of a squirrel-cage induction motor depends upon the secondary resistance, upon which also depends the slip of the motor under load. An excess of secondary resistance would mean poor speed regulation and even a decrease in starting torque. It is stated that in the motor illustrated herewith the secondary resistance has been given such a value that a good starting torque is obtained without requiring an excess of starting current, while at the same time the slip and the efficiency at normal load are satisfactory.

The secondary circuit consists of a squirrel-cage winding, formed of copper bars in partially closed slots bolted to end rings of heavy sheet copper having large ventilating surfaces. For the purpose of minimizing the stored rotative energy, so as to facilitate the reversal of speed in service, the rotor cores are comparatively very small in diameter and long parallel to the shaft. To meet the exacting demands of mill work, the shafts are made extra heavy and the bearings are liberally proportioned.

Squirrel-cage motors usually exert at starting a torque somewhat in excess of the value required by the load. A starting torque larger than demanded by the operating conditions causes unnecessary shocks to the motor and all connected apparatus, and the current taken may disturb the line e.m.f. and cause the lamps to flicker. It is desirable, therefore, to reduce the impressed e.m.f. to such a value as will provide the starting torque required.



MOTOR WITH BRACKET REMOVED TO SHOW STATOR CONNECTIONS, BEARINGS, ETC.

The reduced e.m.f. for starting is obtained from an autotransformer type of starter, whose switch contacts are immersed in oil. The switch contacts consist of copper rods abutting against brass rods, the movement in closing or opening being vertical. It is said that this combination of metals has proved very satisfactory in resisting injury from arcing. The contacts are in two sets, one of which closes in the starting position, and the other in the running position. In closing the switch, helical springs around the contact rods are compressed, the total compression being about 0.5 in. These compression springs insure good contact which improves slightly with use.

About ¼ in. may be worn from the end of each rod of a pair of contacts before they need replacing. In practice these contacts wear away very slowly, the wear after breaking full-load current several thousand times being very slight. When

worn out the ends of the rods, or the arcing tips, can be unscrewed with a pair of ordinary gas pliers, and the new ones substituted.

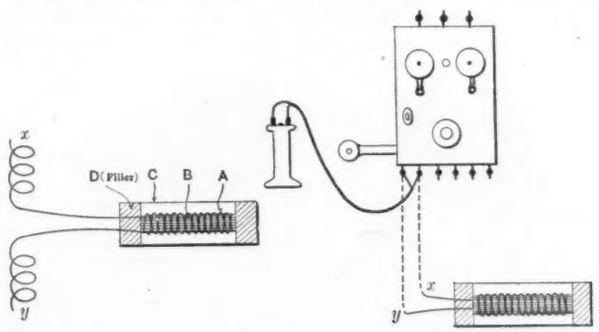
The switch is operated by means of a lever on a shaft running through the lower portion of the transformer case. This lever has three positions—namely, off, starting, and running. A locking device holds the lever in the off position and in the running position until released by pressing the thumb piece in the end of the handle. The handle will not remain in the starting position unless held there by the operator, and on being released returns to the off position.

A mechanical device prevents moving the handle directly from the off position to the running position; it must first be moved to the starting position, the extreme left, and then moved quickly back past the off position to the running position at the extreme right. If this last movement is slow the handle will be caught and held in the off position. This feature is designed to prevent allowing time for the motor to slow down while passing from the starting position, where the motor receives less than the full voltage, to the running position where full voltage is applied.

These mill-motor equipments are made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Telephonic Induction Eliminator.

The device illustrated herewith has been designed for eliminating the buzzing sounds that are commonly present in receivers connected to telephone lines erected in proximity to high-potential circuits. The device provides means by which



FIGS. 1 AND 2.—TELEPHONIC INDUCTION ELIMINATOR.

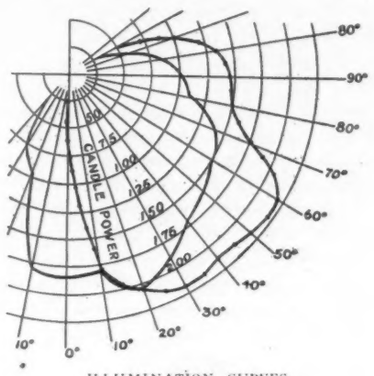
currents induced in the telephone circuit will be caused to take a shunt path in preference to the course over the windings of the receiver.

The device is shown in Fig. 1. It consists of a helix of insulated wire, *A*, having a resistance of about 4.25 ohms, wound continuously on a soft-iron core, *B*, approximately ⅜ in. in diameter and 2 in. long. The core forms an open magnetic circuit. When the core and helix have been constructed and assembled, they are inserted in a brass tube, *C*, about ⅝ in. in diameter and 2.5 in. long, each end of the tube being then filled with an insulating and moistureproof compound, as shown at *D*. It is claimed that when the coil is connected in parallel with a telephone receiver, as shown in Fig. 2, the voice current will take its intended course over the telephone receiver, while the currents produced by external influences will follow the path across the "induction eliminator."

The above-described device has been placed on the market by the Wasatch Electric Service Company, 46 Postoffice Place, Salt Lake City, Utah.

Show-Window Lighting with Tungsten Lamps.

Effective show-window trimming necessarily involves not only a frequent change in goods displayed, but the arrangement of the displays. It is therefore desirable that window-lighting fixtures should be such that the direction of the light can be changed to accord with the periodical changes in window trimming. The curves of the adjoining cut are plotted from

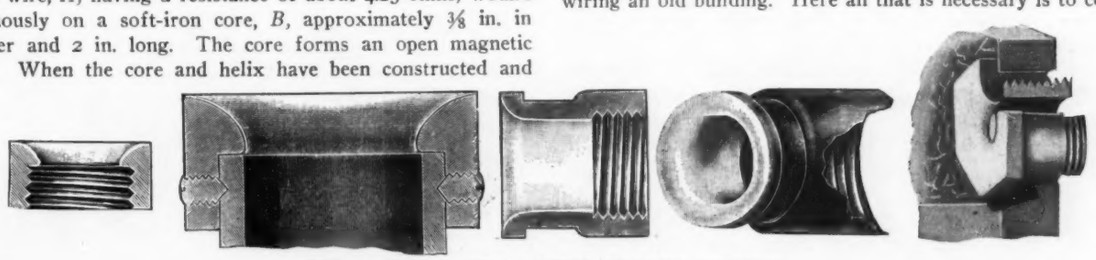


ILLUMINATION CURVES.

photometric measurements taken with a Wheeler reflector (No. 65) in two different positions, the one designed to give a maximum of light directly downward and toward the front of the window, and the other to throw the light on goods displayed at the back and on the back wall of the window. This reflector may be adjusted at any convenient angle while the lamp remains in the vertical position desirable when tungsten lamps are used. The reflector is made by the Wheeler Reflector Company, Boston.

Porcelain-Lined Bushings.

The Code requires that where metal conduits enter junction boxes and at all other outlets, etc., they must be provided with approved bushings fitted so as to protect the wires from abrasion. The device must be made of non-combustible, insulating material which will not absorb moisture. The H. Krantz Manufacturing Company manufactures a line of bushings meeting these requirements and which are especially useful in various classes of wiring work. These are made of annealed cast iron and are lined with porcelain. Fig. 2 shows a set-screw bushing which is convenient for use in places where it is found difficult to place a thread on the conduit, as, for instance, in rewiring an old building. Here all that is necessary is to counter-



FIGS. 1, 2, 3, 4 AND 5.—PORCELAIN-LINED BUSHINGS.

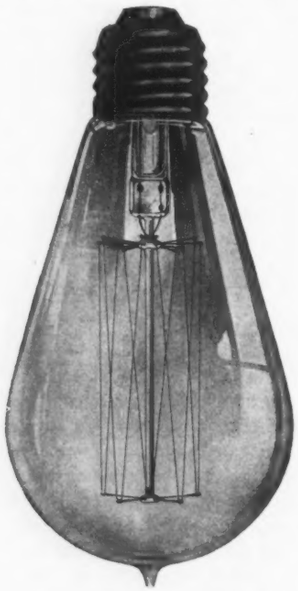
sink the conduit for the point of the set screw, place the bushing over the pipe and tighten the set screw. A bushing used on split outlet boxes is shown in Fig. 3. This bushing has a long neck and is held in position by means of its angular groove between the box and the cover, and makes a good ground connection between the outlet box and conduit. For conduits already equipped with wire, porcelain-lined split bushings are made. These have only to be opened, placed over the conduit and screwed together. A panel bushing is shown in Fig. 5. This is designed to be placed in slate-lined boxes without wiring gutter.

A New Small-Bulb 40-Watt Tungsten Lamp.

Several months ago a 25-watt tungsten lamp was placed on the market with a bulb practically the same as that of the familiar 16-cp carbon-filament lamp, and for which it could be used as a substitute in any fixture or shade. This lamp came into immediate favor and general use, but it lacked one of the chief advantages of tungsten-filament lamps—increase of illumination without increase of current consumption.

The General Electric Company has recently placed on the market a small bulb lamp with a 40-watt tungsten filament giving double the candle-power of the present 16-cp carbon lamp, but taking only four-fifths of the current. This lamp when substituted for the carbon lamp will, therefore, not only materially reduce the cost to the customer, but will greatly increase the standard of illumination by doubling the quantity and bettering the quality of the light given.

As shown by the accompanying illustration, the lamp is about two-thirds size, and it will be seen that the bulb and base are practically the same as that of the ordinary incandescent carbon lamp. The new lamp contains the many improvements in filament construction and methods of support perfected by the General Electric Company. Like other General Electric tungsten lamps it can be burned in any position without affecting its life or candle-power and its small bulb adapts it to all ordinary shades, chandeliers and brackets.



40-WATT TUNGSTEN LAMP.

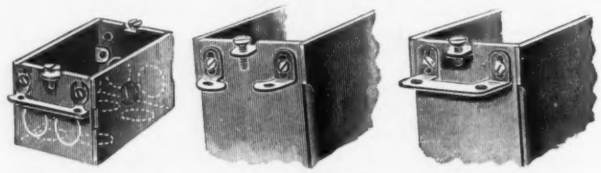
Its price is less than that of the regular large bulb tungsten lamp with shoulder base, and the operating cost, including cost of lamp and current, is less than any incandescent lamp smaller than the 60-watt tungsten. Furthermore, the customer is not required to include in the purchase of the lamp a new outfit of special fixtures, shades, etc. From a commercial standpoint, therefore, it is of particular value to the central station in maintaining its revenue from customers.

The new small-bulb 40-watt lamp can be used in installations now using the old type with shoulder base and holophane reflectors by changing the shade holder from the "H" type to the "O" type. This will raise the reflector around the lamp so as to bring the filament in correct "focus" and obtain practically the same efficient distribution of light from the reflecting and refracting prismatic surfaces.

Shallow Sectional Switch Boxes.

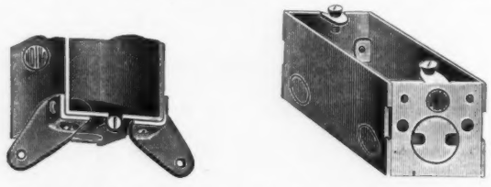
To accommodate the demand for shallow receptacles as well as shallow-type switches, the two kinds of shallow boxes of the sectional type, illustrated herewith, have been designed. They may be employed in thin partitions, outside walls or where for any reason it is not desirable to use a deeper box. Fig. 1 illustrates the loom box, single type, while Figs. 2, 3 and 4 represent types of ears used with this box. Figs. 5 and 6 show the conduit box of the single and two-gang types resepctively. Fig. 7 shows the spacer used to build the box up into a number of gangs. The Chicago Fuse Wire & Manufacturing Company is the maker of these switch boxes.

Referring to Fig. 1, the box shown is 2 in. deep, outside dimensions. The switch lugs are drilled on standard centers, and being formed outward, enable the body of the box to be made short enough to allow the attachment ears to be effectually covered by the flush plate when used in old work. The box is provided with two knockouts in each end, but has none in the back. It may be built up into gangs, and the spacers may be inserted without removing the screws.



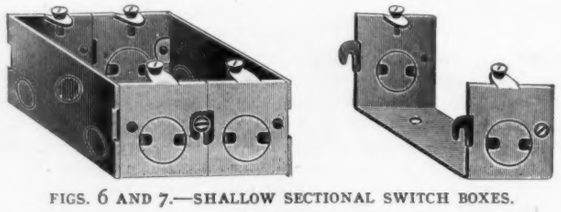
FIGS. 1, 2 AND 3.—SHALLOW SECTIONAL SWITCH BOXES.

Fig. 2 illustrates the regular type of ear. This has the sliding adjustment and reversible feature so that it may be set to various depths when used in new work, according to the thickness of the plaster. Being supported by pivoted connection it may be turned at any angle to strike the lath, which is particularly convenient in old house wiring. In the type shown in Fig. 3 the ears are recessed into the plate; this type is especially desirable for use in connection with a rotary flush switch in which the plate has no supporting screws. The type of Fig. 4 is used only in connection with new work, and is often preferred where a strong anchorage of the switch box is desired. This ear is also provided with an adjustment slot so that the face of the box may be brought out ¾ in. to ⅞ in. from the plaster line. It is of stamped steel and consequently strong.



FIGS. 4 AND 5.—SHALLOW SECTIONAL SWITCH BOXES.

The wall case of Figs. 5 and 6 measures 4 in. long, 2 in. wide, and 1⅞ in. deep, outside dimensions. This is a combination loom and conduit box, having entrance at each end for ½-in. conduit or armored cable and two ⅝-in. openings on either side for loom, these being placed as far from the center as possible so that the ends of the tubing will not interfere with the installation of the switch. As the box is only 1⅞ in. deep it lends itself particularly to use in outside walls where a 1-in. furring strip is used with ¼-in. lath and ⅝-in. plaster, in which case the conduit can be run back of the lath and it is not necessary to recess the box in the brick wall. This box is also suitable where thin partitions are constructed with 1-in. uprights for holding the lath. The combination of conduit and loom outlets in the same box makes it particularly adapted for use where changes are made from conduit or open work.



FIGS. 6 AND 7.—SHALLOW SECTIONAL SWITCH BOXES.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Business during the past week has continued to be quiet and the recovery, that has so long been expected, is yet delayed. While comparisons with the same period of last year are, of course, favorable, there is still considerable disappointment in most lines of trade over the fact that buyers continue to be so strictly conservative. For the dullness, just at the present time, there are definite reasons assigned. The chief of these is the uncertainty as to the tariff and the unwillingness of retail merchants to lay in stocks when a reduction of duties may make future prices much lower. Another reason for immediate stagnation is the unsettled and adverse weather that has prevailed over almost the entire country during the past week. Blizzard, snow and rain have visited various sections and in many parts of the South and Northwest the roads are almost impassable. The most active line, in the jobbing trade, is in cotton goods, summer fabrics and millinery. In these lines it is noted that the finer fabrics for women's wear are the most popular. This is taken to indicate a belief on the part of retailers that there is plenty of money in the hands of consumers to buy the better class of materials and that the cause of delay is largely a lack of confidence. Agricultural implements and supplies for the farm continue to be good sellers, but this is merely the seasonable activity that occurs as the planting time approaches. In the metal industries there is very little doing. The drastic cuts in the prices of steel products have as yet brought out only a moderate amount of orders. The steel mills are certainly disappointed over the returns since "letting down the bars." The best business that was done in this line during the past week was in steel rails, the only product upon which no cut was made. The New York Central Railroad placed orders for 101,000 tons. These orders, the second largest of the year, were mostly given to the independents. The building industry is quiet and plans for the coming season are slow in coming to light. There is some business being done in the lumber trade, mostly in the South and in the far Northwest, but even this is not as active as had been anticipated. In the electrical industries there is little business in sight. Orders for heavy materials are not coming forward and the business being done in small apparatus is only fair. There are many large projects on foot which will require financing, but they are held in abeyance until general business conditions improve. Collections are only fair in spite of the easy money market. Business failures for the week ended March 4, as reported by *Bradstreet's*, were 219, compared with 244 the previous week, 287 in the same week in 1908, 172 in 1907, 177 in 1906, and 190 in 1905.

THE COPPER MARKET.

It is persistently given out among the selling agencies that at least 100,000,000 lb. of copper have been sold within the past 10 days in the New York market. Whether these figures are exaggerated or not, it is certainly true that quite liberal amounts have been taken. The effect upon the market, however, has been very small. Prices have been technically marked up a quarter of a cent, but it is hardly a secret that sales are daily made below the quoted prices and that the large takings that were recently reported were all negotiated at lower figures than present quotations. Another point, worth consideration, is the fact that these sales—which were used to strengthen the prices of copper shares in Wall Street—were made almost exclusively to foreign speculators. In other words, the copper was not taken for consumption and is still in the market. Such copper should not be deducted from the figures representing surplus stocks. It has simply changed hands and has not gone into consumption. As a matter of fact the users of copper have shown little disposition to buy. All of the large manufacturing concerns continued to pursue the hand-to-mouth policy. Even the ability to purchase electrolytic copper at 12¼ cents was no inducement. The statistical position of the market is thoroughly understood and consumers are almost universally of the opinion that a material advance in price is impossible and that lower selling prices are highly probable. The report of the Copper Producers' Association for February will be issued within a few days and it is practically certain that it will show a material increase of "marketable" copper in the hands of producers over the figures given out the month previous. It is predicted that these figures will be in the neighborhood of 185,000,000 lb. This, it must be remembered, does not represent the actual amount of copper in sight. "Marketable" copper means refined copper in the hands of the refiners. It does not mean blister or pig copper ready to be refined in the hands of the smelters or in the hands of the refiners; it does not include the refined copper in the hands of speculators. Taking these stocks into consideration the stocks of copper would be increased 100 per cent. The present situation in a nutshell is this: production, 110 to 120 per cent of normal; consumption, 60 per cent of normal. The exports since March 1 have been 3874 tons. Quotations on the Metal Exchange March 8 were:

Lake	12⅞ @ 13⅛
Electrolytic	12½ @ 12¾
Castings	12⅜ @ 12⅝

London quotations were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	56 12 6	56 10 0
Standard copper, futures	57 7 6	57 5 0
Market	Firm.	Easy.
Sales of spot		200 tons
Sales of futures		600 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.25	12.75
Electrolytic	14.25	12.37½
Casting	14.12½	12.25
London, spot	£64 2 6	£55 17 6
London, futures	64 17 6	56 12 6
London, best selected	67 15 0	59 10 0

BERGMANN UNITED STATES LAMP FACTORY.—It is rumored that the Bergmann Elektricitäts Werke, of Berlin, will establish a tungsten-lamp factory in the United States which will be operated independently of any of the present lamp interests. Mr. Sigmund Bergmann, president of the German Company, was for about 20 years prominent in the electrical manufacturing industry of this country under the firm names of S. Bergmann, Bergmann & Company (later the Edison Machine Works), the Bergmann Gas & Fixture Company, and the General Incandescent Arc Lamp Company. The Bergmann works near Berlin are now among the largest in Europe, giving employment to 6500 men. The capital was recently increased from 14,000,000 marks to 21,000,000 marks, and the operations from the beginning are stated to have been very profitable, as would seem to be indicated by the great growth of the manufacturing works from the small plant started by Mr. Bergmann when he returned to Germany about 1899.

CONTRACTS FOR READING, PA.—The Interstate Engineering & Supply Company, Philadelphia, Pa., S. S. Neff, president, has just let a number of contracts for apparatus to be installed in the new power station now being erected at Reading, Pa., by the Metropolitan Electric Company, among which are the following: To the Allis-Chalmers Company for three 2500-kw turbines and generators with 80 per cent power factor, designed for 60 cycles, three-phase and 13,200 volts. To the Edge Moor Iron Company, Edge Moor, Del. for sixteen 625-hp boilers. To H. R. Heinicke for two brick chimneys, each 242 ft. high. To the General Electric Company for two exciters, and to the Jeansville Iron Works Company, Jeansville, Pa., for three boiler-feed pumps to be driven by turbines.

DUFFERIN (ONT.) POWER-HOUSE CONTRACT.—The Dufferin (Ont.) Light & Power Company will in the course of the next month issue tenders for the construction of a new power house, to contain three 150-kw hydro-electric units. Messrs. Smith, Kerry & Chace, Toronto, are the engineers.

BOONEVILLE (ARK.) PLANT.—The Booneville (Ark.) Light & Water Power Company will build a $150,000 auxiliary steam-power plant and water-works system. Mr. W. A. Fuller, Chemical Building, St. Louis, is engineer.

EXTENDING WIRELESS SERVICE.—There continues to be an active business for the wireless telegraph companies and manufacturers of wireless apparatus in equipping ships with installations. It will not be very long before every ship carrying passengers to and from this country will have voluntarily installed wireless equipment. The bill which was intended to compel this course passed the House of Representatives, but failed to get through the Senate, being sidetracked on account of the press of business in the closing hours of the session. An official of the Marconi Wireless Company says: "There is a disposition on the part of all transatlantic ships to put in long-distance service. A number of ships that have already been equipped with wireless aparatus are changing their instruments for those of higher power. The White Star Line, especially, is adopting this policy. When the *Adriatic* crossed from Europe recently it was in touch with one shore or the other every moment of the voyage. We are meeting with considerable success in the publication of our daily newspapers on board the ships. We send every day from 600 to 1000 words of the most important news and it is served to the passengers at breakfast time."

TELEPHONE OPPORTUNITIES ABROAD.—Notices of the following opportunities to sell telephone apparatus abroad are taken from the trade reports of the Bureau of Manufactures in Washington, from which details may be obtained: An American consul in Canada reports that a local telephone company contemplates extending its service a distance of 170 miles to connect with a neighboring city, in which it proposes to install a complete underground conduit system for the working of its service. The work will include the laying of a cable under a river, the construction of a system of underground conduits in every street of the city, the equipment of a modern central exchange and the installation of an automatic service throughout the city. The contract will involve an expenditure of approximately $500,000. An American consul in Africa has been asked to secure from American manufacturers an approximate estimate of cost of the equipment, exclusive of poles and wires, of a telephone system of 500 instruments.

WESTERN ELECTRIC BUSINESS INCREASING.—During January and February the orders of the Western Electric Company have shown quite a satisfactory growth. Said an official: "If the ratio of increase for these two months over the business done in December continues during the fiscal year the gross sales of the company will be something like $50,000,000. It is probably too much to expect that this will be true, but we certainly are showing a very encouraging growth. Our sales have especially shown a marked improvement in electric-light machinery." Among the large orders which the company has received was one for a low-pressure turbine, 4000-hp capacity, for the new passenger station of the Chicago & Northwestern Railroad. Sales to operating telephone companies are also very good. At the present time the company is employing about 1600 workmen, which is about 75 per cent of the normal number.

GREAT WESTERN POWER COMPANY'S PLANT.—It has been given out in California by Mr. H. P. Wilson, secretary of the Great Western Power Company, that the work of doubling the present capacity of the hydro-electric plant at Big Bend, in the Feather River, will be undertaken as soon as the weather permits. The capacity of the plant is to be increased to 144,000 hp. Work will be begun during the spring on the big dam at Big Meadows, which is high up in the Sierra Mountains. At this point a reservoir will be constructed covering 20,000 acres, in which water will be stored during the winter for use during the dry season. The new work that has been planned is expected to cost $15,000,000.

FOREST PRESERVATION AND HYDRO-ELECTRIC DEVELOPMENT.—The Crocker-Wheeler Company, of Ampere, N. J., has recently become a sustaining member of the Appalachian National Forest Association, the avowed object of which is "the perpetuation, through wise use, of the remaining forests of the country." "Our company is a large builder of hydro-electric power machinery," said one of the officials of the company, "and we believe that the preservation of the forests is of vital importance to hydro-electric development throughout the country. We want to do what we can to help preserve the forests."

ELECTRICAL PLANT FOR LARGE BREWERY.—Under the direction of Mr. J. H. Hallberg, as consulting engineer, Jacob Ruppert's big brewery plant in New York City has just installed two 500-hp Williams cross-compound engines direct-connected with Western Electric direct-current, 125-volt generators and a Williams "Monogram" 100-kw engine. The latter will be operated at 340 r.p.m. The power house of the Ruppert plant will be completely remodeled and a complete new switchboard will be installed to be used in connection with individual-drive motors.

LARGE ILLINOIS ELECTRICAL PROJECTS.—The Rock River Power Company is planning to install an electrical plant at the government dam at Sterling. The equipment will include turbines, generator, etc. The Springfield Light, Street & Power Company is considering the construction of another power plant to take the place of the two plants now operated by the company.

MASSACHUSETTS ELECTRIC COMPANIES.—The gross earnings of the Massachusetts Electric Companies increased $12,000 in February. This is an increase of about 2.66 per cent and compares with a gain of 4 per cent in January and 5 per cent in December.

FORT WAYNE GENERAL ELECTRIC TUNGSTEN-LAMP FACTORY.—The General Electric Company is installing a tungsten-lamp factory in one of the buildings of the Fort Wayne Electric Company.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market during the past week might be described as in a condition of waiting. While business has not been unusually active, the tone of the market has been strong and as a general rule prices have advanced moderately. The most important feature of the week, of course, was the inauguration of the new President. Since the inauguration the Street has done little else than discuss Mr. Taft's address. Opinions differ concerning this, but the majority of the traders in the financial district are very well satisfied and commend its temperate and judicial tone. It was not a matter of surprise that the President declared his purpose to carry out the policies of his predecessor. It was not expected that the prosecution of trusts would be abandoned, and this declaration, therefore, has not added anything to the general uneasiness of financial interests. It is the common opinion that in carrying out these policies Mr. Taft will proceed according to the methods and usages of law; that there will be no violence either of action or of language; that the minds of the public will not be inflamed against the great corporations and that only those which have clearly violated the statutes will be punished or seriously annoyed. Wall Street is particularly well pleased with Mr. Taft's expression upon the tariff. His insistence that a new bill be pushed through as

NEW YORK.

	Mar. 1.	Mar. 8.	Shares sold.		Mar. 1.	Mar. 8.	Shares sold.
All.-Ch.	13⅞	13⅞*	250	Int.-Met., pfd.	41⅛	44¼	28,480
All.-Ch., pfd.	44	43⅛*	1,700	Mackay Cos.	71½*	72¾	400
Amal. Cop.	71	69¼	286,600	Mackay Cos., pfd.	70⅛	71¼	375
Am. D. T.	35*	35*	——	Manhattan Elev.	146*	146*	——
Am. Loc.	52	51⅛	5,540	Met. St. Ry.	25	25*	25
Am. Loc., pfd.	110⅞	111¾*	600	N.Y. & N.J.Tel.	115	117*	80
Am. Tel. & Cbl.	75*	76*	125	Steel, com.	45⅛	45⅛	466,150
Am. T. & T.	128½	128½	6,915	Steel, pfd.	110⅝	111⅛	15,280
B. R. T.	71¾	72½	110,225	W. U. T.	66	65½*	1,400
Gen. Elec.	155	152*	2,200	West'h., com.	78	78	4,300
Int.-Met., com.	15	15¾	15,630	West'h., pfd.	104	110*	200

PHILADELPHIA.

	Mar. 1.	Mar. 8.	Shares sold.		Mar. 1.	Mar. 8.	Shares sold.
Am. Rys.	46	46*	——	Phila. Elec.	11½	11¾	——
Elec. Co. of A.	11¼	12	——	Phila. R. T.	27¼	28	——
Elec. Stor. B'ty	46½	46½*	——	Phila. Traction.	92½	91	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	52⅞	53⅝	——

CHICAGO.

	Mar. 1.	Mar. 8.	Shares sold.		Mar. 1.	Mar. 8.	Shares sold.
Chi. City Ry.	187*	187*	——	Chi. Tel. Co.	129⅜	132¼	——
Chi. Rys., Ser. 1.	112½*	111	——	Met. El., com.	16*	19	——
Chi. Rys., Ser. 2.	44¼	41⅛	——	Nat'nal Carbon.	86	86*	——
Com. Edison	108¼	109¼	——	Nat. Carb., pfd.	118¾*	118¾*	——
Chi. Subways	26*	25¼	——				

BOSTON.

	Mar. 1.	Mar. 8.	Shares sold.		Mar. 1.	Mar. 8.	Shares sold.
Am. Tel. & Tel.	128¾	128⅝	——	Mex. Tel.	2½*	2½*	——
Com. Tel.	125*	127*	——	Mex. Tel., pfd.	5	5*	——
Edison El. Ill.	253	253	——	N. E. Tel.	133	133	——
Gen. Elec.	155½	152¼	——	W. Tel. & Tel.	7*	7*	——
Mass. Elec. Ry.	14	14¾	——	W. T. & T., pfd.	78*	77½	——
Mass. E. R., pfd.	69	72	——				

*Last price quoted.
Shares sold are for week March 1 to March 6.

rapidly as possible is recognized as being the exact policy which will be of the greatest advantage to business interests in general. It is a prevalent opinion that it does not make so much difference what the customs duties in the future will be so long as the matter is quickly settled. It is the uncertainty of the working basis that is held responsible for business depression at the present time. There have been very few real occurrences to disturb Wall Street within the last two weeks. The refusal of the Public Service Commission of the Second District to modify the limitations which it placed around the proposed bond issue of the Erie Railroad was, of course, disappointing, but as very few people really expected that any modification would be obtained, this had little effect upon the market. The uneasiness concerning a possible strike of the coal miners is to some extent shaking confidence in the issues of the coal roads. It is hardly believed, however, that there will be any serious trouble, and if there were more actual news to form a basis for discussion the strike would never be mentioned. The reports from railroads are showing considerable growth. They, of course, compare very favorably with this period of last year, which was one of exceptional stagnation. Both the Pennsylvania and the New York Central systems—two of the greatest in the country—show large gains in gross earnings for February over the same month last year. There is still considerable disappointment felt that the reduction in steel prices has brought out so little new business. Aside from the rail order of the New York Central there has hardly been any new business worth mentioning. The money market continues to be easy and the demand for bonds quite active. Rates on March 8 were: Call, 1¾@2 per cent; 90 days, 2¾@3 per cent. The quotations in the table are those of the close March 8.

DIVIDENDS.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable April 1.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable April 1.

Portland (Ore.) Railway, Light & Power Company, quarterly, 1¼ per cent, payable April 1.

American Smelting & Refining Company, preferred, quarterly, 1¾ per cent, payable April 1; common, quarterly, 1 per cent, payable April 15.

Mackay Companies, preferred, quarterly, 1¾ per cent; common, quarterly, 1 per cent, both payable April 1.

Philadelphia Traction Company, semi-annual, 4 per cent, payable April 1.

NEW YORK INTERBOROUGH SHOWS GAINS.—The report of the Interborough Rapid Transit Company for the quarter ended Dec. 31, 1908, shows a very substantial gain in earnings. The gross earnings for the quarter were $6,786,899, which was an increase of $485,403 over the same period in the previous year. The operating expenses for the quarter were $98,710 more than a year ago, leaving an increase in the gross of $395,693. The largest ratio of improvement was in the business of the subway division. The surplus earned for the first six months of the company's fiscal year, which ended Dec. 31, was $1,475,966, which is just about $100,000 less than the surplus required to pay 9 per cent on the $35,000,000 capital stock. This condition, however, causes no uneasiness as the quarter ended Sept. 30 is always the poorest of the year. The surplus for the last September quarter was only $91,189, while the surplus for the December quarter was $1,384,280. Travel in the summer decreases at least 20 per cent without any proportionate decrease in expenses. The Interborough's funded debt was increased $10,000,000 during the past year by the issue of new notes, and it is not unlikely that the company will have to spend a large amount of money in the near future to transform its cars into the side-door pattern that will probably be demanded by the Public Service Commission.

STANISLAUS ELECTRIC POWER COMPANY.—There has recently been incorporated in San Francisco the California Electric Railways Company, the avowed purpose of which is to build a cross-town street railway several miles long. The company is capitalized, however, at $10,000,000, and it is understood that it is really to become the holding corporation for the Stanislaus Electric Power Company and the Tuolumne Water Power Company, both of which were thrown into the hands of a receiver a few weeks ago as an initiatory proceeding, it has been reported, for turning the property over to the United Railroads of San Francisco. The details of this deal have been published in this journal and the organization of this new company in nowise interferes with the plan as outlined. It is understood that the new company will simply act as the holding company for the water-power property and will in turn be owned by the United Railways Investment Company, which is the holding company of the United Railroads.

HAVANA ELECTRIC RAILWAY COMPANY.—The report of the Havana Electric Railway Company for 1908 shows a very creditable increase in earnings. The gross for the year was $1,937,797, which was an increase of $126,909. The operating expenses only showed an increase of $6,993, and there was a decrease of more than 10 per cent in the cost of operating the power plant. The surplus applicable to dividends was $575,602, out of which was paid the full rate of 6 per cent on the preferred shares and an initial dividend of 1 per cent on the common stock. The general manager of the company says in his report that the generating equipment is ample for all of the present needs of the service and that no additions will be required for some time.

GENERAL ELECTRIC'S FEBRUARY BUSINESS.—The new orders booked by the General Electric Company during February were something less than $4,000,000, as compared with about $6,000,000 in January. This falling off was not unexpected and does not, it is stated, mean any serious decrease in the company's business. As a matter of fact, the January orders were heavily swelled because it was the close of the company's fiscal year and every salesman rushed in every order that was possible. During the past six months the company has consumed about 20,000,000 lb. of copper, and at the present time is buying metal only for its immediate needs.

HELENA (MONT.) LIGHT & RAILWAY COMPANY.—Although no annual statement of earnings has yet been published, it is understood that the Helena Light & Railway Company, which is controlled by J. G. White & Company, New York, had a prosperous year in 1908 and that its business is extending satisfactorily. During the year $20,000 was expended in the electrical department and $15,000 in the railway department. The company expects to expend $15,000 in the lighting department during the coming year and to make considerable additions to the rolling stock and track equipment of the railway.

NEW YORK MUST BUY STEINWAY TUNNEL.—The Appellate Division of the Supreme Court in New York City has decided that the city cannot acquire the Steinway tunnel, the new tube built from Forty-second Street, Manhattan, to Long Island City, which has never as yet been operated, unless it pays the present owners the construction costs. The court holds that the franchises and rights which were granted by the several Boards of Aldermen were not surrendered by the present owners, and that the construction of the subway was lawfully done.

JUDGMENTS AGAINST THE LONGACRE COMPANY.—During the past week five judgments aggregating $25,378 have been entered against the Longacre Electric Light & Power Company, New York City. These are all for interest on bonds issued by the company in 1906. The company has never as yet been able to begin business. The total bond issue was $1,000,000 and a few months ago the Public Service Commission of the First District refused to permit it to increase its stock issue to $10,000,000 and its bond issue to $50,000,000.

FREDERICK (MD.) GAS & ELECTRIC COMPANY.—Henry L. Doherty & Company, of New York City, have taken over the operation and management of the Frederick (Md.) Gas & Electric Company. The property will be put into good condition and an active campaign for business will be inaugurated. Mr. G. R. Trumbull will be the manager of the commercial department for Doherty & Company, and Mr. J. H. Enright will continue as general manager and superintendent of the plant.

TRANSFER OF WATER POWER RIGHTS.—The McCall Ferry Power Company has sold to the Susquehanna Power Company all its property privileges and rights to water power on the Susquehanna River in the State of Maryland. The nominal price paid was $5. Officers of the McCall Ferry Company, in New York, declined to make any statement as to the purpose of the sale.

MONTGOMERY (ALA.) LIGHT & WATER POWER COMPANY.—The second transmission line of the Montgomery Light & Water Power Company from Tallahoosa Falls into the city has been completed. This line, like the one that has already been in use, is operated at 33,000 volts.

MERGER OF LIGHTING PROPERTIES IN NORTHERN INDIANA.—Under the promotion of the C. H. Geist Company, of Philadelphia, the Northern Indiana Gas & Electric Company has been incorporated with authorized capital stock of $5,000,000 and a total authorized bond issue of $10,000,000. The capital stock is divided into $1,000,000 of 6 per cent preferred stock and $4,000,000 common. Mr. C. H. Geist, of Philadelphia, is president of the company, and Mr. C. W. Fox, of Philadelphia, is secretary and treasurer. The object of this new corporation is to merge the properties of the South Shore Gas & Electric Company, of Hammond, Whiting and East Chicago, Ind.; the Michigan City Gas & Electric Company, of Michigan City, Ind., and the Indiana Harbor & East Chicago Electric Company, of East Chicago, Ind. The Northern Indiana starts with no debt and $250,000 in its treasury. Managers for the properties will have headquarters at Hammond and Michigan City. It is planned to erect a new electric generating plant at Hammond next year to cost about $250,000. It is estimated that the properties now consolidated furnish the gas and electric facilities to a present population of about 85,000 in a manufacturing district distinguished by great activity. All of the three companies in the merger have municipal contracts for street lighting. The present operating staffs of the companies concerned in the merger will be continued as heretofore, it is believed.

N. Y., N. H. & H. R. R. WANTS TO OWN TROLLEY LINES DIRECTLY.—The New York, New Haven & Hartford Railroad has made an application to the Public Service Commission of the Second District of New York for permission to purchase from the Millbrook Company the stock of the New York & Portchester Railroad and the New York, Westchester & Boston Railway. These are the two high-speed systems projected from New York to Connecticut, for each of which some rights of way were secured and neither of which was ever constructed. Both of the roads were delayed by litigation and difficulty in financing, and both are now owned by the New Haven Railroad through the intermediary, the Millbrook Company. The present action does not in any way change the ownership and is taken solely for the purpose of getting rid of the dummy holding company. The New Haven company claims that it has advanced all the money that has been spent for rights of way and construction and it wants something to show for its expenditures. It claims that the construction of the line will be rapidly pushed forward.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—There has been an active conversion of 4 per cent bonds into the stock of the American Telephone & Telegraph Company since March 1, when the plan became operative. It is estimated that between $25,000,000 and $30,000,000 worth of bonds were converted during the first week, and that before the end of the month fully $50,000,000, or one-third of the total issue, will have been turned in. It is figured that one-half of the issue will be converted before next November. With the bonds selling in the neighborhood of 94 and the stock selling around 129 there is a very good profit in making the exchange on the basis of $133.73, which is the figure named in the plan.

N. Y., N. H. & H. R. R. MUST DISPOSE OF ITS TROLLEY HOLDINGS.—The full bench of the Massachusetts Supreme Court has affirmed the decision of the lower court which requires the New York, New Haven & Hartford Railroad Company to dispose of its stock holdings in the Worcester & Southbridge, Worcester & Blackstone Valley, Worcester & Webster, Webster & Dudley, the Berkshire and the Springfield Street Railway companies before July 1, 1909. This practically checkmates the plans of the New Haven road for forming a great trolley merger in Massachusetts. No announcement has been given out as yet as to the future disposition of these traction properties.

WESTERN UNION TELEGRAPH COMPANY.—It is predicted that the quarterly report of the Western Union Telegraph Company for the first quarter of 1909 will show a substantial increase over the same quarter last year. The business of the company has been gradually improving, and the net revenues for the last quarter of 1908 approximated $2,000,000. This was almost double the revenues for the same quarter in 1907. It is expected that if business continues to grow better the company will have no difficulty in resuming the customary 7 per cent dividend.

BOSTON ELEVATED EARNINGS.—The report of the Boston Elevated Railway Company shows that during the year 1908 273,000,000 passengers were carried on its lines. The gross income of the company amounted to $14,074,000. Wages, cost of power, damages and legal expenses absorbed $8,441,000, or 60 per cent, of the gross income. The cost of power for the road shows a constantly increasing tendency. This is attributed to the advancing expense of coal.

METROPOLITAN SECURITIES COMPANY STOCK.—At an auction of securities in New York City March 4, 137 shares of stock of the Metropolitan Securities Company were sold for $135. This stock, the par value of which is $100 a share, and, which is 75 per cent paid in, sold on the New York Stock Exchange in January, 1903, at 128¾.

ANDERSON (S. C.) TRACTION STOCK.—The Anderson (S. C.) Traction Company is offering $150,000 preferred stock to take the company out of the hands of a receiver and to build a nine-mile extension to Pelzer. It is reported that the stock is being satisfactorily taken up.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Gas & Electric Company:					
Quarter ended Dec. 31, 1908	$652,364	$469,054	$183,310	$78,525	$66,525
Quarter ended Dec. 31, 1907	540,362	386,570	153,792	78,525	22,463
Chicago Railways Company:					
December, 1908	974,365	710,665	263,699	158,136	134,172
December, 1907	851,791	606,988	244,802	134,459	110,343
Colorado Telephone Company:					
Year 1908	2,709,701	1,866,682	843,019	.....	.....
Year 1907	2,514,366	1,756,767	757,599	.....	.....
Crosstown Street Railway Company, Buffalo:					
Quarter ended Dec. 31, 1908	195,598	126,103	69,494	37,175	18,897
Quarter ended Dec. 31, 1907	170,007	108,028	61,979	37,175	12,406
Cuyahoga Telephone Company, Cleveland:					
Year 1908	828,009	377,732	450,277	205,999	244,278
Year 1907	781,586	346,913	434,673	207,458	227,215
Easton (Pa.) Consolidated Electric Company:					
Year 1908	70,263	12,301	57,962	61,850	*3,888
Year 1907	103,997	8,230	95,761	59,525	36,242
Indiana Union Traction Company, Anderson, Ind.:					
Year 1908	1,902,330	1,058,745	843,585	854,249	*10,644
Year 1907	2,088,232	1,111,198	978,934	728,115	249,919
Interborough Rapid Transit Company:					
Six months to Dec. 31, 1908	12,115,786	5,367,514	6,748,272	.....	.....
Six months to Dec. 31, 1907	11,456,623	5,220,661	6,235,962	.....	.....
International Railway Company, Buffalo:					
Quarter ended Dec. 31, 1908	1,084,778	757,289	327,489	231,908	42,442
Quarter ended Dec. 31, 1907	1,128,063	734,312	393,750	239,926	99,613
Keystone Telephone Company, Philadelphia:					
January, 1909	89,781	44,481	45,300	.....	.....
January, 1908	87,945	47,267	40,678	.....	.....
Michigan State Telephone Company:					
Year 1908	3,366,875	2,455,447	911,428	418,300	493,128
Year 1907	3,092,225	2,044,973	1,047,252	443,251	604,001
Nashville (Tenn.) Railway & Light Company:					
January, 1909	138,969	83,585	55,384	32,450	18,752
January, 1908	124,877	79,444	45,433	30,193	11,465
Toronto Electric Light Company:					
Year 1908	1,155,582	715,712	439,870	289,254	150,616
Year 1907	1,039,716	651,926	387,790	245,503	142,287

*Deficit.

GENERAL NEWS

Construction News.

COLUMBIA, ALA.—A. D. Wood, of this city, is erecting a new 15,000-spindle cotton mill. It is proposed to develop 1000 hp to drive the machinery.

HUNTSVILLE, ALA.—The Huntsville Railway, Light & Power Company has submitted a propositon to the City Council offering to furnish street lighting for a term of five years at the rate of $66.66 per lamp per year. In case electricity developed by water power is transmitted to the city within that period, the price will be reduced to $50 per lamp per year.

PRATT CITY, ALA.—Arrangements are being made by the People's Home Telephone Company to install a larger switchboard in the local exchange and to improve the telephone service generally.

SHEFFIELD, ALA.—The Sheffield Company expects to purchase mechanical stokers and feed-water heater for 1200-hp boilers and coal crusher. J. B. McClary is general manager.

FLORENCE, ARIZ.—The Consolidated Telephone Company is planning to extend its telephone line from Florence to Kelvin and Ray in the near future.

PHOENIX, ARIZ.—The People's Independent Telephone Company is preparing to extend its telephone system to the Mesa, Tempe, Scottsdale and Glendale sections.

BOONEVILLE, ARK.—The Booneville Light & Water Company has engaged W. A. Fuller, consulting engineer, Chemical Building, St. Louis, Mo., as engineer in charge of the construction of its proposed hydro-electric plant, including an auxiliary steam power plant and water-works system. A steel concrete dam about 350 ft. in length and 100 ft. high will also be constructed. A pipe line and transmission line seven miles in length will be built to supply the city of Booneville with water and electricity. It is expected that bids for construction and apparatus will be received about May 1. John P. Thayer is president and W. Earl Harrell, secretary. The cost of the combined plants is estimated at $150,000.

EUREKA SPRINGS, ARK.—The Citizens' Electric Company is planning to install a 300-kw 2-phase 60-cycle 2200-volt turbo-generator set and a 300-kw direct-current 550-volt turbo-generator set for railway service. A. M. Barron is general manager.

HOPE, ARK.—The contract for the construction of the proposed power plant in Hope is reported to have been awarded to T. C. Crosnoe for $5,460.

PRAIRIE GROVE, ARK.—A franchise has been granted to the Prairie Grove Telephone Company to install a telephone system in Prairie Grove.

AGNEW, CAL.—Contracts have been awarded by the Board of Managers of the Agnew State Hospital for boiler room, power plant equipment, etc., as follows: For engine to the Engineering & Maintenance Company for $6,750; boilers to the Risdon Iron Works for $26,400, and for generators to Barrett, Folk & Downing for $5,150. The management has authorized advertisements for bids for the construction of underground conduits for the hospital.

GRIDLEY, CAL.—The Board of Trustees has awarded the contract for pumping plant for the city water works to the Nevada Machinery & Supply Company, for $7,820.

LOS ANGELES, CAL.—The Board of Supervisors has awarded the contract for the electrical and telephone work, in connection with the proposed new hall of records and county office building, to Woodill & Hulse Electrical Company, of Los Angeles, for $15,850.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 23 to furnish at the navy yard, Mare Island, Cal., ammeters and voltmeters, as per Schedule 986. Blank proposals will be furnished upon application to the navy pay office, San Francisco, or to the above-named bureau. E. B. Rogers, paymaster-general, U. S. N.

SAN FRANCISCO, CAL.—Judge De Haven, of the United States Circuit Court, has issued an order to Vanderlynn Stow, receiver of the Tuolumne Water Power Company, the Stanislaus Electric Power Company and the Union Construction Company, to expend $5,000 per month in maintenance and keeping the property in good condition. George H. Whipple, receiver of the Stanislaus Electric Power Company, the Stanislaus Railway Company, Tuolumne Water Power Company and the Union Construction Company, has been authorized by Judge De Haven, of the United States Circuit Court, to expend $12,100 per month in maintenance and preserving the properties. The Knickerbocker Trust Company brought actions for foreclosure of mortgage, owing to a default on interest payments.

BRECKENRIDGE, COL.—The Central Colorado Power Company will furnish the Wellington Mines Company, of Breckenridge, with electricity to operate a 200-ton stamp mill.

BRANFORD, CONN.—Announcement has been made by the Connecticut Company that a 24-hour electric service will be established in its Branford District, comprising the towns of Branford and Guilford, beginning June 1, 1909. Electricity will also be furnished for motors. E. T. Gilbert is superintendent.

NOANK, CONN.—The Whitall Electric Company, of Westerly, R. I., has been awarded the contract for the installation of two electric motors in the carpenter shop of R. Palmer & Sons' shipyard.

DOVER, DEL.—The House of Representatives on March 2 passed a bill authorizing the State to grant a subsidy of $100,000 to an electric railway to run through the State. It is proposed to parallel the Delaware division of the Pennsylvania Railroad.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 16 for furnishing the naval station at Annapolis, Md., with the following supplies: Schedule 991—Two portable testing sets; a General Electric controller and generator. Application for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received by the Bureau of Navigation, Navy Department, Washington, D. C., until March 24 for outside lighting at the naval training station, Great Lakes, North Chicago, Ill. Blank forms of proposals and specifications will be furnished upon application to the commandant of naval training station, Great Lakes, North Chicago, Ill. J. E. Pillsbury is chief of bureau.

AMERICUS, GA.—The contract for street lighting and pumping of water supply between the city and a local corporation having been declared invalid by Judge Littlejohn in a recent decision, the City Council will call an election immediately to vote on the proposition to issue $40,000 in bonds, the proceeds to be used to establish an electric light plant in connection with the municipal water-works system.

ATLANTA, GA.—A favorable report has been made to the General Council on a resolution granting a franchise to the Piedmont Power Company, organized to supply electricity in Atlanta. The company has a capital of $3,000,000. A power plant is located on Tugaloo River, where about 18,000 hp is said to be available. Mr. L. B. Magid, of Tallulah Lodge, Ga., is president of the company.

AUGUSTA, GA.—The Augusta Railway & Electric Company is making arrangements for enlarging its power plant and making other improvements to its system. James U. Jackson is vice-president.

CARROLTON, GA.—An election has been ordered for March 30 to vote on the question of issuing bonds for either purchasing and enlarging the local electric light plant or for building a new plant. The contract for lighting, now held by a private concern, expires shortly.

GORE, GA.—Arrangements are being made to erect a new telephone line from Greenbush to Summerville. Another line is also planned from Subligna to the Floyd County line.

GAINESVILLE, GA.—The property and holdings of the Gainesville Electric Railway Company have been sold at public auction by S. C. Dunlap, commissioner, to R. L. West, of Atlanta, for $80,000. The property is bonded at $250,000. Mr. West is manager of the General Contracting Company in Atlanta.

WALLACE, IDAHO.—The Slate Creek Electric Light & Power Company has been granted a franchise to operate its system in Wallace. The company is constructing a hydro-electric plant on Slate Creek at a cost of $200,000. H. J. Rogers is vice-president.

WALLACE, IDAHO.—The City Council has granted a franchise to the Spokane, Wallace & Interstate Railway Company, which proposes to construct an electric railway 100 miles in length, connecting Wallace, Cœur d'Alene and Spokane, Wash. William J. Hall, of Wallace, is manager.

BOWEN, ILL.—The Village Board has granted a franchise to E. E. Bennet to construct and operate an electric light plant.

EAST MOLINE, ILL.—The stockholders of the United Light & Power Company are contemplating increasing the capital stock of the company, the proceeds to be used for extending the service and increasing the equipment of the plant.

STERLING, ILL.—Arrangements are being made by the Rock River Power Company to install electric machinery at the power plant at the government dam. The work is nearly completed, with the exception of installation of turbines, generator and other apparatus.

SPRINGFIELD, ILL.—It is reported that the Springfield Light, Heat & Power Company contemplates the construction of another power plant to take the place of the two plants now operated by the company.

WEST POINT, ILL.—It is reported that contracts have been awarded by the West Point Electric Light Company for equipment for an electric light plant. The plant will have an output sufficient to supply 100 lamps to begin with.

BLUFFTON, IND.—It is reported that arrangements have been made for financing the Bluffton, Berne & Celina Traction Company, which pro-

poses to construct an electric railway from Bluffton, Ind., to Celina, Ohio, by the way of Berne. Rudolph Schug is president.

COLUMBUS, IND.—The Central Indiana Lighting Company has been notified that the work of putting up a new power house, installing new equipment and otherwise improving the plant must be commenced by March 15 under penalty of forfeiture of franchise. No part of the contract with the city has been fulfilled and no further extension of time will be given.

FAIRMONT, IND.—The Central Indiana Lighting Company is planning to make improvements to its system and establish a 24-hour service. J. E. Jeffries, of Alexander, is manager.

INDIANAPOLIS, IND.—The Laycock Power House Company has filed an amendment to its charter, increasing its capital stock from $100,000 to $150,000.

LEBANON, IND.—The Elizaville Co-operative Telephone Company has increased its capital stock for the purpose of extending and improving its plant. M. E. Shirley is secretary.

LIBERTY, IND.—The Town Board has granted a franchise to the Richmond Electric Light Company to light the town with electricity.

NORTH MANCHESTER, IND.—The Eel River Telephone Company has increased its capital to $30,000 for the purpose of improving and extending its system.

TERRE HAUTE, IND.—Work has commenced on the construction of the railway of the Terre Haute & Merom Southwestern Traction Company. The company plans to furnish electricity for lamps. D. M. Roberts, of Terre Haute, is president and general manager.

YORKTOWN, IND.—The citizens are considering the question of installing a street lighting system.

WHITESTOWN, IND.—The Whitestown City Telephone Company has increased its capital stock by $20,625, the proceeds to be used to make improvements and extension to its plant. J. T. F. Laughton is secretary.

CLEARFIELD, IA.—The Clearfield Telephone Company is contemplating the installation of a new switchboard and cables.

DES MOINES, IA.—Bids will be received by George F. Poorman, city clerk, for supplies for the several departments for the fiscal year ending April 10, 1910, including electrical and engineers' supplies, etc.

DES MOINES, IA.—The Board of Supervisors has awarded the contract for the installation of an electric light and power plant for the Polk County court house and jail to the Erie City Iron Works, Erie, Pa., for $10,750. Harry B. Frase is city auditor.

DUBUQUE, IA.—The Farley & Loetscher Manufacturing Company has awarded a contract for the construction of a new power house for its woodworking plant at Eighth and White Streets. Contracts for the equipment have been placed.

MARSHALLTOWN, IA.—The business men of Marshalltown are considering the question of organizing a public utilities corporation, with a capital stock of $200,000, to furnish electricity and gas for lighting purposes at a cheaper rate. At a meeting held $70,000 was raised and a committee appointed to secure the balance. It is proposed to furnish electricity at 10 cents per kw-hour and gas at $1 per 1000 cu. ft. Consumers are now paying 14 cents per kw-hour for electricity and $1.45 and $1.65 per 1000 cu. ft. for gas. D. T. Denmead, president of the First National Bank, is interested in the project.

SIOUX CITY, IA.—The New State Telephone Company is planning to erect a long-distance telephone line to Minneapolis, via Sheldon.

BELPRE, KAN.—The Belpre Telephone Company contemplates the construction of two telephone lines south of the town.

JUNCTION CITY, KAN.—It is reported that the Junction City Electric Railway, Light & Ice Company will reorganize with a capital stock of $600,000 for the purpose of entering the gas business.

PARSONS, KAN.—Work will commence at once on the construction of the local street car system. The street railway interests have purchased the plant of the Parsons Electric Light & Power Company and propose to rebuild it to furnish electricity to operate the railway. Cyrus E. Mead, of Dayton, Ohio, is building the railway.

EOLIA, KY.—The Upper Cumberland Telephone Company has made connections with the Whitesburg Telephone Company's lines and it is said that the company will erect new telephone lines to connect with the East Tennessee Telephone Company's system at Appalachia, Va. E. L. Creec, of Eolia, is manager.

LEXINGTON, KY.—Contracts will be placed by the Lexington & Interurban Railways Company in the near future for the construction of a 12-mile extension from Lexington to Hopkinsville. E. K. Dewey is general manager.

WASHINGTON, LA.—A franchise has been granted to the Valley Telephone Company, of Warren, Ark., for the installation of a telephone system in Washington. F. E. Bell is local manager.

BINGHAM, MAINE.—Arrangements are being made by the Bingham Electrical Company to replace the engine in its plant, which was recently destroyed.

FRANKLIN, MAINE.—The Franklin Power Company has applied to the Legislature for permission to transmit and distribute electricity in the towns of Farmington and New Vineyard.

KENNEBUNK, MAINE.—The committee appointed recently to look into the question of increasing the output of the municipal electric light plant has recommended that $6,500 be appropriated to purchase electricity for an auxiliary steam plant. The present plant is operated by water power, but during the low-water periods the plant has not been able to meet the demands made upon it.

PITTSFIELD, MAINE.—The Messalonskee Electric Company, of Waterville, Maine, has purchased the controlling interest in the Sebasticook Power Company, in this place. The plant is located about five miles below Pittsfield, on what is known as the Thirty Mile Rips, and has an output of about 1500 hp. The power house is also equipped with an auxiliary steam plant, with a rating of 400 hp; the company also has a large substation in this town. The new owners will continue to furnish electrical service as before and also agrees to furnish electricity for industrial purposes. Early in the spring the company proposes to erect a transmission line 16 miles long from its new plant to Waterville, where it is proposed to utilize electricity from this plant with other plants owned by the company, to be used for lighting purposes and for operating the Lewiston, Augusta & Waterville Electric Railway. The Messalonskee Electric Company now has three electric plants under its control, viz., the original plant in Oakland, with an output of 1000 hp, and the Fort Halifax Power Company's plant in Winslow, of 2000 hp, and the Pittsfield plant.

BARRE, MASS.—W. G. Webber, president of the Marlboro Electric Company, has submitted a proposition to C. E. Haven, chairman of the Board of Selectmen, offering to furnish electricity in Barre for lamps and motors. The company offers to extend its transmission lines to the town provided the town would enter into a contract for street lighting to the amount of $1,200 per year and guarantee 25 individual consumers and not less than 150 hp of 10 hours a day load for power purposes. The rate for street lamps is $18 per lamp per year for tungsten lamp of 40 cp on a 1 o'clock, moonlight schedule. The charge for electricity for commercial lighting will be from 15 cents to 12 cents per kw-hour, according to the amount consumed, and for motors from 12 cents down to 2½ cents per kw-hour, according to the amount used.

DOUGLASS, MASS.—The citizens of Douglass Center have petitioned the Selectmen for electric street lamps in the village and on the road between Douglass and East Douglass, a distance of two miles.

FALMOUTH, MASS.—The question of lighting the town by electricity is under consideration. Eugene Carpenter states that if he can secure franchises in the towns of Wareham, Bourne and Falmouth that he would install an electric light plant during the coming summer.

LAKEVILLE, MASS.—Plans are being made for the construction of the State Tuberculosis Hospital in Lakeville. The contract for construction of the buildings, including power house, has been placed.

LEXINGTON, MASS.—The plant and holdings of the Lexington Gas & Electric Company have been purchased by the Edison Electric Illuminating Company, of Boston. The company furnishes electricity and gas in the towns of Lexington and Bedford. The local electric plant will be dismantled, and electricity for operating the system will be furnished from Boston. The gas plant and business will be sold to other interests.

NORTH BROOKFIELD, MASS.—The Oxford Linen Mills Company, which recently purchased land and water rights along Mad Brook, is planning to erect a power house in the gorge below the dam and install a 250-kw generator and will transmit electricity to its mills, two miles distant. At present the mills are operated by steam power. F. E. Winchell is president of the company.

SOMERSET, MASS.—The Fall River Electric Light Company has applied to the town authorities for permission to erect transmission lines for the distribution of electricity in Somerset for lamps and motors.

SPRINGFIELD, MASS.—The members of the Springfield Power Associates are contemplating extensive improvements to the property of the steam power company, recently purchased. The association has purchased a site of about 3½ acres, on which it will erect an eight-story building to be utilized for manufacturing purposes. The motive power will be changed from steam to electricity, at a cost of about $50,000. The improvements contemplated will cost about $200,000.

TOPSFIELD, MASS.—Plans are being considered to light the town by electricity. It is proposed to organize an association and purchase electricity from either Danvers or Beverly to supply the residents with electricity for lamps and motors. Messrs. Dow, Merrill, Clark, Ward, Williams and Woodbury are interested in the project.

WESTFIELD, MASS.—The report of the municipal gas and electric plant for the last year shows a profit of $24,738, of which $11,580 came from the electric plant. Manager George Pettibone and C. N. Oakes, treasurer, recommended that the power plant be increased by 500 or 750 hp by the installation of an engine and dynamo in the present power station, at a cost of from $25,000 to $30,000.

WORCESTER, MASS.—The Worcester Electric Light Company has purchased a 500-kw Westinghouse motor-generator set for use in direct-current power service. The set consists of a 500-kw, 550 to 600-volt generator direct connected to a 2300-volt, three-phase, 60-cycle synchronous motor wound for a speed of 514 r.p.m.

ALPENA, MICH.—The Huron Portland Cement Company has recently purchased a 500-kw Allis-Chalmers turbo-generator set. It is said the company may require auxiliary apparatus.

YPSILANTI, MICH.—The Washtenaw Home Telephone Company has decided to make extensions to its system. It is said that the company will give especial attention to the rural telephone lines in the vicinity of Ypsilanti.

BROOKPARK, MINN.—Arrangements are being made to organize a telephone company to construct a telephone line to Pomeroy Lake, a distance of 20 miles.

DULUTH, MINN.—The Water & Light Board has awarded a contract for a double-acting triplex pump and accompanying appliances for the new station of the middle water system at Fifteenth Avenue and Sixth Street to the General Electric Company, Schenectady, N. Y., for $6,400.

McINTOSH, MINN.—The Garden Valley Co-operative Telephone Company has purchased the local telephone exchange. It is said that the company proposes to improve the system and extend the telephone lines into the surrounding country.

MINNEAPOLIS, MINN.—The Sageng Threshing Machine Company, Minneapolis, Minn., will soon purchase equipment for its new plant, part of which will be electric motor-driven. The company will also purchase equipment for its power plant as follows: One 300-hp engine, new or second-hand, with condenser and heater complete; one 300-hp Babcock & Wilcox boiler, 150-lb. pressure, with pump and injector; one 150-kw, two-phase, 60-cycle, 2200-volt, 600 r.p.m. Westinghouse generator, complete with sliding rail, pulley exciter and switchboard complete. The company, which was organized a few months ago, has purchased an old street railway plant, located between St. Paul and Minneapolis, on the Minneapolis Transfer Railroad, which will be remodeled and equipped at a cost of about $75,000.

HATTIESBURG, MISS.—The Home Telephone Company has secured the right-of-way for its telephone line from Gulfport to Hattiesburg, and is now making arrangements for right-of-way from Hattiesburg to Jackson. The company recently made an appropriation of $45,000 for the erection of a telephone line to connect Hattiesburg, Meridian, Gulfport, Jackson and Vicksburg, with local exchanges in each of the cities named.

BOONEVILLE, MO.—T. W. Bast, of Sedalia, Mo., architect, has been engaged by the Kemper Military Academy to prepare plans for the construction of an electric light plant.

KANSAS CITY, MO.—The Kansas City-Southeastern Traction Company has been granted permission to increase its capital stock from $180,000 to $5,000,000. The company on Feb. 17 filed a mortgage for $5,000,000 in favor of the Carnegie Trust Company, of New York, N. Y., on about 125 miles of main lines and 65 miles of branch lines that are to be built. The main railway will extend from Kansas City to Jefferson City, and the branches from Lee's Summit to Pleasant Hill and Harrisonville; another branch line is also contemplated from the main line at Pittville, through Holden, thence to Clinton. Work on the construction of the railway between Kansas City and Lee's Summit will begin as soon as the weather will permit. Charles A. S. Sims is president.

ST. LOUIS. MO.—The Union Electric Light & Power Company has submitted a proposition to the Board of Public Improvements, offering to substitute magnetite arc lamps for the present direct-current arc lamps now in use on the streets, provided that necessary legal arrangements can be made. The change is to be made without additional cost to the city under the new contract, which goes into effect Sept. 1, 1909, under which the city is to pay the rate of $50 per lamp per year.

VALDA, MO.—A telephone company has been organized in Valda. The officers of the company are: D. W. Stephens, president; Milton Smith, secretary, and Fred Meyer, treasurer.

HAMILTON, MONT.—The citizens are considering the question of installing a municipal electric light plant.

TONAPAH, NEV.—The Nevada-California Power Company will extend its transmission lines from Tonapah to Manhattan and Round Mountain to furnish electricity to the northern camps and mines and mills. It is expected to have the system completed and in operation by May 15.

CONCORD, N. H.—The Connecticut River Power Company has applied to the Legislature for permission to increase its capital stock and to distribute and sell electricity throughout Cheshire County; also for right of eminent domain as to location of poles and wires on private property. Frank H. Streeter, of Concord, N. H., is president of the company.

ELIZABETH, N. J.—The Board of Freeholders has authorized the public grounds and buildings committee to consider the question of installing an electric light plant to furnish electricity to light the county buildings.

HOBOKEN, N. J.—It is reported that plans are being prepared for the construction of a high-speed electric railway from Paterson to Hoboken to connect with the Hudson River tunnels. It is said that the North Jersey Construction Company will build the proposed railway. The present plans include the construction of a temporary power house.

ORANGE, N. J.—The Council has decided to hold an election May 4 to vote on the proposition to establish a municipal electric light plant.

PERTH AMBOY, N. J.—The Standard Underground Cable Company is erecting a new wire mill and will install a 750-hp Westinghouse horizontal gas electric unit to furnish power to operate the plant.

ALBANY, N. Y.—The Rose Telephone Company, of Delaware County, has filed an amendment to its charter giving its permission to extend its telephone systems in various counties. The directors of the company are: Hugh K. Rose, E. Scott Rose, C. Edward Hanford, William E. King, Ferris E. Davis and E. R. Harkness.

BUFFALO, N. Y.—Mayor Adam on March 1 approved the bill authorizing the city to issue $37,500 in bonds to pay for the city's share for the proposed electric lighting plant at the city hall. The cost of the plant is estimated at $75,000, for which the city is to pay half and the county the other half.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Commission in Lunacy, Albany, N. Y., until March 24 for the construction of nurses' (attendants) home, including heating, plumbing and electrical work; also for two horizontal tubular boilers, engine, generator and for switchboard, etc., at the Central Islip State Hospital, Central Islip, Long Island, N. Y. Drawings and specifications for the above work may be seen and blank forms of proposal obtained at the above institution, or at the office of the State Commission in Lunacy, 1 Madison Avenue, New York, N. Y., and at the office of Franklin B. Ware, State Architect, Albany, N. Y.

FULTON, N. Y.—It is stated that the Niagara Power Transmission Company contemplates making application to the local authorities for a franchise to furnish electricity in Fulton for lamps and motors. In case the Niagara company secures a franchise here it will be necessary to erect a substation.

KINGS PARK, N. Y.—Bids will be received until March 24 by the State Commission in Lunacy, Albany, N. Y., for the construction of power house, coal pocket and conduits, including plumbing and electrical work; also for construction of laundry building, including heating, electrical work, etc., at the Kings Park State Hospital, Kings Park, L. I., N. Y. Plans and specifications can be seen and blank forms of proposals secured at the above hospital and at the office of the State Commission in Lunacy, 1 Madison Avenue, New York, N. Y., and at the office of Franklin B. Ware, State Architect, Albany, N. Y.

LESTERSHIRE, N. Y.—The Board of Trustees is considering the question of establishing an electric light plant in connection with the municipal water-works system at a cost of about $10,000. It is said that the question will be submitted to the voters at the coming village election. At present the village has a contract with the Binghamton Light, Heat & Power Company, which does not expire until 1910. Under the present contract the village pays about $90 for each arc lamp. It is said that the company is willing to reduce the price to $70 per lamp per year if a satisfactory contract can be made.

NEW YORK, N. Y.—The Public Service Commission, First District, has approved the franchise granted to the Bronx Traction Company by the Board of Estimate, for the construction of 1200 ft. of double track from Classon Point Road and West Chester Avenue to a point east of the Bronx River. F. W. Whitridge is receiver.

NEW YORK, N. Y.—Bids will be received until March 15 by C. B. J. Snyder, superintendent school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., for installing electric equipment in addition to and alterations in Public School No. 126, on Meserole Avenue, Borough of Brooklyn; for installing electric equipment in addition to and alterations in Public School No. 128, on Twenty-first Avenue, Borough of Brooklyn; for installing electric equipment in new Public School No. 160, on Fort Hamilton Avenue, Borough of Brooklyn; for installing electric equipment in new Public School No. 163, on Benson Avenue, Borough of Brooklyn; for completing and finishing the installation of electric equipment in new Public School No. 89, on Orchard Avenue, Borough of Queens, in accordance with original plans and specifications awarded to L. F. Benn, which have been declared abandoned.

NIAGARA FALLS, N. Y.—The Niagara Falls Hydraulic Power & Manufacturing Company has submitted a proposition to the City Council, offering to take over the present pumping station and supply electricity for operating the new plant. The company offers to purchase the site on which the present station stands and supply electricity at the rate of $9 per hp up to 800 hp to operate the new plant.

POUGHKEEPSIE, N. Y.—Sealed proposals will be received by the State Commission in Lunacy, Albany, N. Y., until March 24 for the construction of power house, trestle and conduits; also for construction of conduit, including steam piping, for acute hospital, at the Hudson River State Hospital, Poughkeepsie, N. Y. Plans and specifications can be seen and blank forms of proposals obtained at the above hospital and at the office of Franklin B. Ware, State Architect, Albany, N. Y.

RIVERHEAD, N. Y.—Muralt & Co., of New York, N. Y., have been awarded the contract for remodeling and enlarging the hydro-electric power plant on the Peconic River at Tower Mills, L. I. New vertical turbines will replace the old water wheels now in use, and an additional unit of the same general design will be installed.

SCHENECTADY, N. Y.—Plans are being prepared by the General Electric Company for the installation of a complete electric light and power plant in the proposed addition to the store of H. S. Barney Company in this city.

VAN HORNESVILLE, N. Y.—It is reported that D. S. Tilyou is interested in a project to construct an electric railway from Van Hornesville to Henderson.

WEST POINT, N. Y.—Bids will be received by the quartermaster, West Point, until March 19, for furnishing and installing an electrical distributing and street lighting system for the cadet camp.

BURLINGTON, N. C.—The Southern Traction & Power Company has been incorporated to develop a water power on Haw River, near this town. J. W. Murray is the principal promoter of the new enterprise. Holdings on which 1400 hp can be developed have been secured, being

located principally in Alamance County, and the power to be developed will be disposed of to manufacturing towns in that vicinity. Application has also been filed for franchises to permit the company to build transmission lines through Reidsville, Wentworth and other towns in the State. The company is capitalized at $3,500,000.

WADESBORO, N. C.—Work at Blewitt's Falls, on the Cape Fear River, has been completely stopped, on account of litigation in which the promoting company is involved. About $200,000 has been expended on the development and the same amount will be required to finish the work on the power plant.

NEW SALEM, N. D.—The business men of New Salem are considering the question of installing an electric light plnat.

ASHLEY, OHIO.—The Village Council has appointed a committee to make investigations in regard to the cost of establishing an electric light plant here.

DAYTON, OHIO.—It is reported that an ordinance will be introduced into the Council authorizing the proper committees to confer with the officials of the street and interurban railways in regard to having the latter provide lamps on their rights-of-way, so that the city may utilize the money saved in this way to extend the lighting system into the suburbs.

FINDLAY, OHIO.—The city has subscribed $125,000 for the construction of the proposed Marion & Findlay electric railway, which will be 47 miles in length. Garry W. Meeker, of Columbus, Ohio, and R. P. Hankey, of Detroit, Mich., are interested in the project.

LORAIN, OHIO.—The Citizens' Gas & Electric Company has submitted a bid to the City Council offering to furnish electricity for lighting the streets of the city at the rate of $64 per lamp per year.

PARIS, OHIO.—The Farmers' & Merchants' Telephone Company has increased its capital stock from $1,200 to $21,000. T. W. Wartman is president.

PERRYSBURG, OHIO.—The Village Council has awarded the contract for street lighting to A. C. Tryon, of Maumee, for a term of 10 years at the rate of $50 per lamp per year. The village now pays $80 per lamp per year for the service, which is furnished by William Witzler, of Perrysburg.

RAVENNA, OHIO.—Plans are being made by the Central Union Telephone Company to rebuild its local telephone system and improve the service.

STRUTHERS, OHIO.—It is reported that the Council is considering the question of granting a franchise for lighting the streets of the town by electricity.

WOOSTER, OHIO.—Bids will be received by the Board of Public Works until March 22 for lighting the streets, alleys, etc., in the city for a term of 10 years. C. W. Van Ness is clerk.

YORK, OHIO.—Arrangements are being made by the York Telephone Company for the construction of a trunk line from Byhalia to York, Raymond, East Liberty and West Mansfield, a distance of about 30 miles. An exchange will be installed in each of the towns. As soon as this line is completed it is proposed to build a telephone line to Richwood.

MEDFORD, OKLA.—An election will be held March 17 to vote on the proposition of granting a franchise to the Medford Ice, Light & Power Company to furnish electricity in all the city buildings.

SAPULPA, OKLA.—The Sapulpa & Interurban Railway Company is preparing plans for the construction of an electric railway from Sapulpa to Glen Pool, a distance of 10 miles; also to build a local system in Sapulpa of about 5 miles, and a branch to Tanneha, 3½ miles in length. H. E. Clark, of Glen Campbell, Pa., is president, and H. H. McFann, of Sapulpa, general manager.

VINITA, OKLA.—Plans are being made to erect a telephone line to connect Vinita and Centralia. M. South, of Miles, and others are interested in the project.

JASPER, ORE.—A new telephone company has been organized, with Gainey Jacoby as president.

PORTLAND, ORE.—The United Railways Company has nearly completed its extension from Portland to Holbrook, and service will be inaugurated on the road about the middle of this month. Arrangements are being made to extend the line to Forest Grove.

REDMOND, ORE.—Arrangements are being made by a local company to install a power plant at Redmond at a cost of about $30,000. The company is capitalized at $50,000 and the officers are: Joseph H. Jackson, president; H. F. Jones, secretary and treasurer, and J. G. McGriffin, engineer, all of Redmond.

ALTOONA, PA.—The Altoona, Hollidaysburg & Bedford Springs Electric Railway Company has secured the right-of-way for its proposed electric railway from Altoona to Bedford Springs, a distance of 49 miles. The cost of the railway is estimated at about $5,000,000.

BEAVER, PA.—The Beaver County Telephone Company has made application for a franchise to operate a telephone system in Beaver.

CHESTER, PA.—The Beacon Light Company, it is said, will soon commence work on improvements to its plant, which will cost about $125,000. It is proposed to enlarge the power house and install direct-connected machinery, discarding all belt-driven machinery.

EASTON, PA.—A bill has been introduced in the Legislature by Representative Hugh W. Ramsey, of York County, providing for a State telephone exchange. The bill asks for an appropriation of $500,000 for construction work for the next two years, the cost of construction and maintenance to be derived from a telephone tax. The patrons of the system are to bear the cost of the installation of their telephones.

HAZLETON, PA.—Arrangements are being made by the Susquehanna & Southern Railroad Company for the construction of an electric railway from Hazleton to Pottsville, a distance of 32 miles. The third-rail system will be installed. The company has not yet decided whether it will erect its own power station or purchase electricity from the Harwood Power Company, which is now erecting a large power plant at Harwood.

LANSDOWNE, PA.—The City Council has granted a franchise to the Philadelphia & Delaware County Electric Railway Company to construct an electric railway from Scottdale Avenue to Baltimore Avenue and Union Avenue.

PHILADELPHIA, PA.—Plans are being considered by an independent company to construct an electric railway between Bridge Street, Frankford, and Bustleton and Somerton. The road will be about 4½ miles in length. The Philadelphia Rapid Transit held a franchise for the railway, which has expired.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia & Reading Railroad Company for extensive improvements to one of its Port Richmond docks, adapting it for the handling of ore. The sides of the pier will have space for electrically operated gantry cranes, which will have a capacity of 300 tons per hour. A power plant to operate the cranes will be located on the pier.

WASHINGTON, PA.—Plans are being made by the Wheeling & Elm Grove Railway Company to extend its electric railway from the present terminus at West Alexander to Claysville. The Pittsburg Railways Company, which has recently completed an electric railway from Pittsburg to Washington, has entered into an agreement with the Wheeling & Elm Grove Railway Company to extend its system to Claysville to connect with the Wheeling system.

WAYNESBURG, PA.—The City Council has granted the Waynesburg & Monongahela Electric Railway Company a 99-year franchise. The company proposes to construct an electric railway through Waynesburg, Washington, Jefferson, Clarksville, Mariana, Millsboro, Frederickstown, Mount Morris, Carmichels, Greensboro and South Brownsville, with Waynesburg as a center.

WILKES-BARRE, PA.—The stockholders of the Consolidated Telephone Companies of Pennsylvania have voted to install an automatic exchange in this city at a cost of $200,000.

ANDERSON, S. C.—It is reported that the Anderson Traction Company has decided to extend its railway from Belton to Pelzer, a distance of nine miles. At Pelzer the railway will connect with an extension to be built from Greenville.

CHARLESTON, S. C.—A bill to grant a charter to the Edisto Power Company was passed by the House of Representatives Feb. 25.

CHESTER, S. C.—The Wylie Cotton Mills have contracted with the Southern Power Company for electricity to the amount of 250 hp for operating the mills. The new electrical machinery will be shipped about April 1.

GREENVILLE, S. C.—The Town Council has withdrawn the franchises of the Greenville Gas, Electric Light & Power Company and the Paris Mountain Water Company, declaring the same invalid and ordering that formal notice to this effect be served on the companies. The chairman of the light committee of the Town Council has been instructed to communicate with the Southern Power Company as to terms for furnishing electrical service.

GREENWOOD, S. C.—It is reported that the contract has been awarded for the construction of an electric railway from Greenville to Williamston. It is said that the railway may be extended from Williamston to Greenwood.

LEXINGTON, S. C.—Plans are being considered by Perry Hall, of Lexington, for the organization of a company to construct a cotton mill. Mr. Hall is now developing a water power of 1000 hp to generate electricity to be transmitted to the mill.

WESTMINSTER, S. C.—Plans are being made by W. E. Creswell to organize a company to construct a cotton mill. It is proposed to develop a water power, recently purchased, to generate electricity to operate the mill.

OKOBOJO, S. D.—The farmers in the vicinity of Okobojo have organized under the name of the Gas Belt Telephone Company of Okobojo. The company has purchased the telephone lines of the Great Western system. The company proposes to erect additional rural telephone lines.

BINGHAMPTON, TENN.—Plans have been completed by J. M. Trenholm & Company for the construction of a large grain elevator in Binghampton, to be operated by electricity, furnished by the Binghampton Power Company, whose plant is now under construction.

LEBANON, TENN.—Work has commenced on the construction of the Lebanon Woollen Mills, which will be operated either by steam or electricity. H. M. Freeman is general manager.

MEMPHIS, TENN.—It is reported that Eastern capitalists, represented by John B. Wheeler, are making arrangements to construct an electric railway from Memphis to Jackson. The syndicate has established headquarters in the Lee Building, Memphis, Tenn.

CORPUS CHRISTI, TEX.—M. Ucovitch has applied to the City Council for a franchise to construct and operate an electric street railway in Corpus Christi.

EL PASO, TEX.—The Mesilla Valley & El Paso Interurban Railway Company has completed financial arrangements for the construction of its proposed electric railway to connect Las Cruces and other Mesilla Valley towns with El Paso. The company is in the market for about 40 miles of track and overhead line material, and also for complete equipment for power station. Contracts for the work will be placed through H. A. Baum, 33 Michigan Avenue, Chicago, Ill., and O. H. Baum, El Paso.

PALESTINE, TEX.—George W. Burkett, president of the Palestine Electric & Ice Company, is making arrangements to construct an electric street car system in Palestine and will soon apply to the City Council for a franchise. It is also stated that Mr. Burkett contemplates organizing a company to build an electric railway from this city to Dallas.

TAYLOR, TEX.—Application has been made to the City Council by W. B. Johnson, of Palestine, Tex., and associates, for a franchise to construct and operate an electric light and gas plant in Taylor. The Citizens' Electric Light & Power Company has petitioned the Council for a new franchise in lieu of its present franchise.

WICHITA FALLS, TEX.—The plant and holdings of the Wichita Falls Water & Light Company have been purchased by J. A. Kemp, Frank Kell and I. H. Kempner. It is said that the plant will be enlarged to furnish electricity for the proposed new electric railway between Wichita Falls and Lake Wichita, a distance of about 5 miles.

RUTLAND, VT.—The Rutland Railway, Light & Power Company is contemplating extending its electric railway from Castleton to Poultney, a distance of 6 miles. George S. Haley is general manager.

DANVILLE, VA.—The Dan River Power & Manufacturing Company, it is said, has decided to build another mill, to be equipped with 50,000 spindles and 1500 looms. The mill will be operated by electricity generated by water power, with a steam auxiliary plant. The new plant will cost approximately $1,000,000. Lockwood, Green & Co., of Boston, Mass., are the architects.

BELLINGHAM, WASH.—It is reported that the power plant at Nooksack Falls, owned by the Stone & Webster Company, will be enlarged to meet the increased demand for electricity in this city. J. B. Lukes is district superintendent.

TACOMA, WASH.—The Board of County Supervisors has granted John M. Bell a franchise to erect a telephone line to Longmire's Springs, the Government reserve and the National Park, through Paradise Valley.

YACOLT, WASH.—The Town Council has granted a franchise to J. Coulter for the construction of an electric light and power plant.

FAIRMONT, W. VA.—The Fairmont & Clarksburg Traction Company contemplates the construction of a new substation and the installation of two 300-kw rotary converters. G. T. Watson is manager.

BALDWIN, WIS.—The Baldwin Telephone Company is considering the question of extending its telephone lines to Hersey and Emerald.

LOMIRA, WIS.—It is reported that Steer Brothers, of Knowles, Wis., are contemplating the installation of an electric light plant in Lomira.

MILWAUKEE, WIS.—The Dings Electro-Magnetic Separator Company is completing an addition to its Bay View plant and installing Wagner single-phase motor drive.

WAYSIDE, WIS.—The capital stock of the Wayside Telephone Company has been increased from $2,000 to $10,000, the proceeds to be used for extensions to its system.

CALGARY, ALB., CAN.—The following contracts have been awarded in connection with the municipal street railway system to be built this summer: Motor generator and switchboard set to the Allis-Chalmers-Bullock Company, of Montreal, for $15,950; one 750-hp, 3 cylinder, compound engine, to the Robb Engineering Company, of Amherst, N. S., for $14,300, and a quantity of rails, spikes, ties, etc. Address Mayor Jamieson.

NELSON, B. C., CAN.—The city has purchased all the rights and equipment of the Nelson Tramway Company and will immediately reconstruct the system and put it in operation. For further information address W. Garland Foster, Nelson, B. C.

VANCOUVER, B. C., CAN.—C. F. Pretty has purchased the timber tract holdings of the Canadian Industrial Company, on the east coast of Vancouver, and proposes to install a power plant, pulp and saw mills.

VERNON, B. C., CAN.—J. C. Kennedy, of the Stav Lake Power Company, Vancouver, B. C., has completed surveys and estimates for the development of water power in this vicinity to generate electricity to operate an electric street railway system here and for lamps and motors to towns in this vicinity.

DAUPHIN, MAN., CAN.—Bids will be received until March 15 by Napoleon Tessier, secretary of Department of Public Works, Ottawa, for wiring the public building, now under construction at this place.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by M. Peterson, secretary of the civic board of control, until April 15 for two transformers, one of 30 kw at 80,000 volts and the other 200 kw at 200,000 volts, also for control equipment for same. Plans and specifications may be seen at the office of Smith, Kerry & Chace, Confederation Life Building, Toronto, Ont., Can., and also at the office of F. E. Cambridge, city electrician, Winnipeg, Man.

PORT ARTHUR, ONT., CAN.—Surveys have started at Dog Lake Falls preliminary to the development of power there by this city. Address Mayor Carrick.

TORONTO, ONT., CAN.—Cecil B. Smith has closed a deal at Ottawa involving the expenditure of $1,000,000 for power development in the Cobalt district to supply the mines there.

YORKTON, SASK., CAN.—The Yorkton Northwest Electric Light & Telephone Company has increased its capital stock from $20,000 to $50,000.

DAWSON CITY, Y. T., CAN.—The Dawson City Light & Power Company's plant will be moved to Sourdough Coal Mine, 40 miles southwest. It will also be enlarged and arrangements have been made for distributing electricity to mines within a radius of 100 miles.

GUADALAJARA, MEX.—It is reported that a syndicate of Colorado Springs men, who own the controlling interest in the Guanajuato Power & Light Company, has purchased the electric street railway system and electric light and power plants in Guadalajara for $8,500,000 (Mexican money).

Company Elections.

MACON, GA.—At the annual meeting of the directors of the Macon Gas Light & Water Company H. T. Powell was re-elected president.

CINCINNATI, OHIO.—At the annual meeting of the stockholders of the Union Gas & Electric Company the following directors were elected: Norman G. Kenan, J. T. Carew, Reuben Holden, Jr., M. E. Moch, W. E. Hutton, F. R. Williams and Charles H. Davis, all of Cincinnati; Archibald S. White, Alvin Young, A. B. Leach and H. L. Daugherty, of New York, N. Y.; F. B. Enslow, of Huntington, W. Va.; J. W. Gill, of Steubenville, Ohio, and Olaf Ussing and George Heard, of Pittsburg, Pa.

New Industrial Companies.

THE ASSOCIATED ENGINEERING COMPANY, of Louisville, Ky., has been incorporated with a capital stock of $15,000 by John H. L. Vogt, Herman F. Scholtz and T. J. McFarland.

THE KAISER DEVICE & ELECTRIC COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical devices by Edwin D. Klopp, Frank Kaiser and C. D. Coyle, all of Buffalo, N. Y.

THE UNIVERSAL ENGINEERING CORPORATION, of Glen Cove, N. Y., has been incorporated with a capital stock of $3,000 by Henry T. Shotwell, of Glen Cove, N. Y.; Charles L. Lee, and Henry A. Ingraham, of Brooklyn, N. Y.

THE ELECTRA LIGHTNING ROD COMPANY, of Chicago, Ill., has been chartered with a capital stock of $10,000 by J. S. Swenson, E. E. Stehlik and L. M. Stehlik. The company propoess to manufacture electrical apparatus and appliances.

THE ROTHCHILD ENGINE COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Frederick Van Wyck, Joseph Rothchild and Charles H. Simmins, all of New York, N. Y. The company proposes to manufacture machinery and tools.

THE D-B CONTROL COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 by John Darby, of Summit, N. J.; Clifford D. Meeker, of East Orange, N. J., and Harold D. Meeker, of New York, N. Y. The company proposes to do a general contracting and electrical business.

New Incorporations.

DOTHAN, ALA.—The Newton Springs Telephone Company has been organized to construct a telephone line from Dothan to Hodgesville. The officers of the company are: C. L. Jackson, president; J. D. Holton, secretary, and C. F. Gilstrap, treasurer.

MILFORD, DEL.—The Draper Telephone Company has been organized by the farmers of Slaughter Neck to erect a telephone system. The officers are: Joseph Gray Davis, president; Harry M. De Puty, vice-president; J. H. Vreeland, secretary, and David Argo, treasurer.

BELLEVILLE, ILL.—Articles of incorporation have been filed for the Southern Illinois Electric Company, of East St. Louis, by Hamilton Paro, Ira L. Pendleton and Harry Bean. The company is capitalized at $6,000.

CHICAGO, ILL.—The Illinois Inland Electric Railway Company has been chartered, with a capital stock of $50,000, to construct an electric railway from Springfield through Sangamon and Christian counties to Pana. The incorporators are: George W. Davidson, Carl O. Beroth, Thomas C. Kennedy, Albert E. Wolf and William J. Eaker, all of Chicago, Ill.

CELESTINE, IND.—The New Home Telephone Company, of Dubois County, has been incorporated to build and operate an exchange and telephone lines in Celestine and Dubois County. B. Nordhoff, George W. Jacobs and L. L. Jacobs are directors.

LA PORTE, IND.—The various gas and electric plants in northern Indiana owned or controlled by Clarence H. Geist, of Chicago, Ill., and Philadelphia, Pa., have been consolidated under the name of the Northern Indiana Gas & Electric Company, with a capital stock of $10,000,000. The present local management of the various plants will not be changed, but will be under one general management. Frank J. Canall has been elected president and Rollo M. Cole, secretary. The new corporation has absorbed the gas and electric plants at Michigan City, Hammond, Valparaiso, Indiana Harbor and East Chicago.

PALMYRA, IND.—The Flat Woods Independent Telephone Company has been incorporated, with a capital stock of $500, by O. P. Martin, M. A. Smith, Lawrence Ellis and others.

CLERMONT, IA.—The Gunder & Clermont Telephone Company has been chartered, with a capital stock of $4,000. The officers of the company are: H. S. Groth, president; A. O. Olson, vice-president; G. L. Ostlie, secretary and treasurer.

Personal.

COL. W. T. GENTRY has been elected president of the Southern Bell Telephone Company, with offices at Atlanta.

MR. L. B. RAMSDEN, of Port Colbourne, Ont., has been appointed manager of the municipal electric light and power plant at Wingham, Ont.

MR. OTTO KNEY has resigned as manager of the publicity department of the Northern Electrical Manufacturing Company, in order to return to journalistic work.

PROF. B. B. BRACKETT, of the Clarkson School of Technology, gave an address March 1 before the Watertown (N. Y.) Society of Engineers on the subject "Electrical Transmission by Analogy."

MR. J. R. A. HOBSON, who has recently been acting as general commercial superintendent of the Southern Bell Telephone Company, has been appointed to that office, with headquarters in Atlanta.

MR. H. C. SLEMIN, of Rochester, N. Y., has been appointed to the dual position of sales manager and advertising manager of the Stromberg-Carlson Telephone Manufacturing Company, with offices at Rochester.

MR. C. LE MAISTRE has been appointed secretary of the International Electrotechnical Commission, London, the duties of which office he had previously discharged as acting secretary. Prof. Elihu Thomson is president of the commission in succession to the late Lord Kelvin.

MR. S. PIEK has peen appointed assistant general manager of the Niagara, Lockport and Ontario Power Company, with office at Buffalo. Mr. H. B. Vincent has been appointed superintendent of the same company, with office at Mortimer, and Mr. W. E. Ryan as chief operator, with office at Mortimer.

MR. HAROLD ALMERT, of Chicago, the manager of the Wichita (Kan.) Gas, Electric Light & Power Company, has resigned with the object of taking up new work along the same line, but on a larger scale. He leaves with the best wishes of the officers and staff of the company. He will be at liberty after April 1.

MR. THOMAS G. GRIER delivered an address on the work of the Panama Canal before the Dames of the Loyal Legion, at the Grand Pacific Hotel, Chicago, on March 1. Mr. Grier, who has written a book on the canal that has been well received, is an earnest advocate of the upholding of the hands of the American engineers who are building the canal.

MR. C. S. DAVIDSON, who has been secretary of the Vermont Power & Lighting Company and the Consolidated Lighting Company at Montpelier, Vt., has resigned to accept a position with the Holophane Company, representing it in Ohio and Michigan. During 1908 Mr. Davidson secured for the Vermont enterprises some very lucrative lighting and sign business.

MR. R. B. STICHTER has been appointed general manager of the Texas Traction Company, operating the Dallas-Sherman Interurban system. Mr. Theodore Stebbins, former general manager, will continue with the company in an advisory capacity. Mr. Stichter, who is president of the Southwestern Electrical & Gas Association, resigned as general manager of the Strickland gas and electric properties to accept the new position.

MR. GEORGE WESTINGHOUSE, Jr., was married March 4 at Irton, Cumberland, England, to Miss Evelyn Brocklebank, daughter of Sir Thomas Brocklebank. The young couple will reside at Pittsburgh, where Mr. Westinghouse will resume his duties as assistant general manager of the works of the Westinghouse Air Brake Company. Miss Brocklebank and Mr. George Westinghouse, Jr., have known each other from childhood through the friendship which has existed for a period of 40 years between their fathers, which was marked by frequent exchanges of family visits.

MR. EUGEN EICHEL, who for several years was connected with the General Electric Company in this country and has frequently contributed to the technical press both here and abroad, has assumed charge as editor of *Elektrische Kraftbetriebe und Bahnen*, published in Berlin, Germany, with which journal he has been connected editorially from its commencement. He will receive assistance from a publishing committee consisting of the former editor, Prof. Dr. W. Reichel, Director of the Siemens-Schuckert Works; Director K. Wilkens, of the Berlin Electricity Works, and Privy Councillor G. Wittfield, Minister of Public Works, who is in charge of the electrification of the Prussian Government Railways.

Obituary.

MR. W. C. B. SAWLER, engineer of the Radio Telephone Company, died recently at Bombay, India, at the age of 37. Mr. Sawler was formerly connected with the Stone Wireless Telegraph Company.

MR. W. E. REYNOLDS, switchboard engineer of the Chicago Telephone Company, died at his home in Chicago on Wednesday, Feb. 24, after a short illness. Mr. Reynolds was graduated from the electrical engineering course of the University of Wisconsin in 1899, and since was associated with the engineering department of the Chicago Telephone Company. Mr. Reynolds had a large circle of friends in the telephone field who will mourn his untimely death.

MR. H. H. WOODWORTH.—It is with deep regret that we record the death of Mr. Harmon H. Woodworth, the advertising manager and assistant sales manager of the Automatic Electric Company, of Chicago. This talented and amiable young man for the past few years had taken an active share in the introduction of the company's well-known automatic telephone system, and the literature issued by him in this connection was admirably designed and executed.

COLONEL HENRY B. WILSON, of the banking firm of Emerson, McMillin & Company, New York, died suddenly, March 7, at Bonaire, Ga. Colonel Wilson was 62 years of age and came to New York about 20 years ago from Ohio. He was interested in many electrical and industrial concerns and was a director in the American Light & Traction Company and the Consolidated Gas Company, of New York; the Western Gas Company, which controls the Milwaukee lighting plant, and the Southern Light & Traction Company, of San Antonio, Tex.

Trade Publications.

TUNGSTEN LAMPS FOR STREET LIGHTING.—The ease with which the Tungsten lamp is adapted to street lighting is shown in bulletin No. 4647, just issued by the General Electric Company, Schenectady, N. Y. The bulletin contains curves showing candle-power distribution of this lamp under different conditions, illustrations of constant-current transformers and series lamp socket used in connection with the lamp, and several diagrams showing the advantages to be derived from the use of the tungsten lamp for series street lighting.

ELECTRICALLY OPERATED AIR COMPRESSOR.—Bulletin No. 1513 of the Allis-Chalmers Company describes a portable compressed-air outfit equipped with a direct or alternating-current motor, whereby the compressor with its various accessories can be brought directly to the work instead of having the compressed air transmitted from a distance through pipes and flexible tubing. A great advantage of the electric compressor is in its application to air brakes, and bulletin describes the manner in which it is adapted for this and other purposes.

STORAGE BATTERY IN STEEL MILLS.—The Electric Storage Battery Company, Philadelphia, has issued Bulletin 112, covering the use of storage batteries in iron and steel mills. Examples of installations are given, such as those at the Illinois Steel Company, Lukens Iron Steel Works, besides the Edgar Thompson Works, the Duquesne Works and the Youngstown works of the Carnegie Steel Company. The greatest application of electricity to rolling mills is, of course, the new installation at Gary, Ind., which is described. It is pointed out that the functions of the storage battery in steel and iron mills are, first, regulation at the end of the line; second, direct-current powerhouse regulation; third, alternating-current powerhouse regulation; fourth, combination direct and alternating-current regulation. In all of these cases the battery can be used as a reserve in case of a breakdown while getting other apparatus into service. It is stated that the total capacity of "chloride" batteries installed by the Electric Storage Battery Company in the various steel and iron mills is upward of 50,000 amp at the regular rate of discharge.

Business Notes.

THE AUTOMATIC SWITCH COMPANY has removed its offices to the Hudson Terminal Building, 50 Church Street, New York.

THE STAVE ELECTRICAL COMPANY, 27 West Twenty-seventh Street, New York, has appointed the Robertson Electric Company, 15 Terrace, Buffalo, N. Y., as its representative for Western and Northern New York.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY has made a change in its management, Mr. J. P. Clare having resigned and Mr. C. de Waal being appointed to the position of general manager. Mr. de Waal, who was formerly the general European agent for the company, has planned to make strong connections in all the principal cities of this country and to carry on an aggressive campaign.

WM. E. QUIMBY, INC., has leased the building 548-550 West Twenty-third Street, New York, to which will be moved the factory from South Boston. At the new location a jobbing business will be carried on in addition to the manufacture of Quimby screw pumps and the Quimby drainage pumps. The company will begin operation in the new quarters May 1.

KIMBLE ELECTRIC COMPANY IN NEW QUARTERS.—Owing to the demand for the variable-speed motors made by the Kimble Electric

Company, of Chicago, the company has found it necessary to remove to larger quarters, and it is now to be addressed at 324 West Washington Boulevard, Chicago. Here the floor space available is more than three times as much as that of the old factory, and the manufacturing capacity is greatly increased. Mr. Kimble reports that it is difficult to keep pace with the orders for the company's new motor.

CROCKER-WHEELER ORDERS.—Among the large orders recently taken by the Crocker-Wheeler Company is one for an 800-kw and a 75-kw, 250-volt generator for the Emerson Manufacturing Company, Rockford, Ill. Another is for a 300-kw, 125-volt lighting and power generator for the Oakville Company, Oakville, Conn. The High Standard Steel Company, of Rockaway, N. J., has purchased two 125-kva, 23,000-volt, 60-cycle, 600-r.p.m. alternators of the coupled type. Two 50-kw turbo-generators have been ordered for the De Laval Steam Turbine Company, Trenton, N. J., and several engine-type generators of moderate size, among which are a 75-kw machine for the Franklin Square House, Boston, and a 50-kw machine for the Enterprise Building Company, Fall River, Mass. Eight motors for printing presses have been ordered for Clark & Cox, Denver, Col. Among other orders are one for three 10-hp elevator motors for the Ogden Iron & Steel Manufacturing Company, New York City, and a 40-hp induction motor for the Stiles & Hart Brick Company, Wier Branch, Mass.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 2, 1909.

[Conducted by William F. Bissing, Pat. Law, 2 Rector St., N. Y.]

913,684. ELECTRIC BURGLAR-ALARM; A. Bloch, Paris, France. App. filed March 28, 1907. For the locks of doors, etc. The circuit of an electric bell is closed by means of two contact devices arranged, for example, under the carpet of the room when the burglar enters.

913,691. VARIABLE-SPEED MOTOR; James Burke, Erie, Pa. App. filed May 17, 1905. A direct-current motor is provided with additional coils connected to a common point whose potential is between that of the positive and negative brushes. By connecting the supply mains to the brushes or to the additional point of connection, two speeds are obtained. The field strength may also be varied.

913,718. SPACE TELEGRAPHY; L. De Forest, New York, N. Y. App. filed June 25, 1907. Provides simple, harmonic impulses for tuning circuits to a spark frequency by connecting the aerial to a source of practically continuous oscillations of a frequency higher than the limit of audibility and at the same time providing a variable resistance in the earth connector with means for harmonically varying the same as by a tuning fork.

913,734. TELEPHONY; I. Kitsee, Philadelphia, Pa. App. filed Nov. 22, 1905. Provides sources of inductance along the line circuit for loading the line together with cores for the inductances normally magnetized independently of the current transmitted over the line.

913,747. APPARATUS FOR ELECTROPLATING; G. L. Meaker, Chicago, Ill. App. filed Nov. 20, 1907. The articles are passed continuously through the bath and are rotated during the plating operation.

913,753. LIGHT-REGULATOR FOR ELECTRIC LAMPS; T. E. Murray, New York, N. Y. App. filed Jan. 23, 1907. For varying the luminous intensity of electric lamps by means of a rotary shaft, a plurality of disks of non-conducting material thereon and a plurality of tapered conducting plates carried by the disks for controlling the circuit of the lamps, thus making and breaking the circuit rapidly.

913,754. ELECTRIC-FUSE BOX; T. E. Murray, New York, N. Y. App. filed March 19, 1908. The interior of the box with the cover closed is divided into three compartments insulated from each other. The insulating partitions are carried partly by the cover and partly by the box.

913,755. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed Sept. 2, 1908. A base block with removable fuse plugs with visual indicating means to show the position of the plugs. The circuit may be broken by the plugs in either the positive or negative conductor of a three-wire system or in both by reversing the position of the proper fuse plug or plugs.

913,757. ALTERNATING-CURRENT REGULATOR; R. S. McLeod, Disbury, Manchester, England. App. filed Oct. 22, 1906. Connects to the rotor a flywheel, the case of which is electrically connected to the mains and which case may be rotated at various speeds in one direction or the other.

913,782. ELECTRIC TRACTION OF THE SURFACE-CONTACT SYSTEM; D. Suchostauer, London, England. App. filed March 5, 1908. The necessary insulated conductors and studs are built in sections or self-contained units.

913,792. GERMICIDE LINING FOR MOUTHPIECES FOR VOICE-TRANSMITTING INSTRUMENTS; A. A. Williams, Charlotte, N. C. App. filed July 14, 1908. Provides a plurality of nesting cups inserted into the mouthpiece, which can be successively removed and thrown away.

913,795. TESTING SYSTEM FOR TELEPHONE LINES; C. S. Winston, Chicago, Ill. App. filed May 29, 1905. Systems in which a talking battery is located at the substation and the battery for testing the busy or idle condition is located at the central station. In making the busy test the maximum effect is produced upon the operator's receiver by means of an induction coil connected in series with the receiver, the primary of which is suitably energized, the induced current from the secondary winding adding its effect to that in the first winding to cause a distinct click in the receiver.

913,805. STAGE BORDER-LIGHT; J. C. Bronaugh, Kansas City, Mo. App. filed Jan. 30, 1908. A fireproof structure in which the lamps are protected from breakage by moving scenery by providing an angle plate with a guard secured thereto. the angle plate and guard protecting the lamp.

913,809. ELECTRIC SWITCH; E. M. Carr, Newcastle, Ind. App. filed March 14, 1908. Arranged on the pole near the consumer's premises so that the current may be turned off or on without entering the premises and comprises a switch with a pair of conductors whose adjacent portions are embedded in an insulator and a movable member carrying by one of the conductors and movable into and out of contact with the other.

913,810. ELECTRICAL SWITCH; T. Clark and I. Vlasto, Stockton Heath, England. App. filed Dec. 14, 1907. For motor starters. A spindle carries a plurality of spaced contact strips adapted to close the circuit through a plurality of resistance coils, each alternate coil wound in an opposite direction to the other coil or coils, together with a blowout.

913,814. MEANS FOR CONTROLLING DIRIGIBLE TORPEDOES; L. E. Custer, Dayton, O. App. filed July 23, 1906. An auxiliary de-coherer, positively insures a reversal of the current in the motor by means of which the torpedo rudder is actuated through suitable relays. Means are provided for preventing interference from other stations and for observing the path of the torpedo.

913,824. GALVANIC BATTERY; B. Jonas, Toledo, O. App. filed May 2, 1906. The air serves as a depolarizer in a galvanic cell having an iron electrode. A porous absorbent fabric is secured to the electrode.

913,827. PROCESS OF PURIFYING WATER; H. Korten, Chicago, Ill. App. filed Dec. 9, 1907. Purifies feed water for steam boilers by subjecting the water to electrical action and then filtering through mercury.

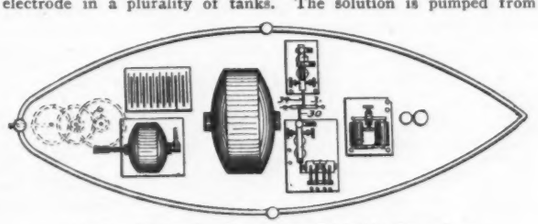
913,831. SWIVEL FOR ELECTRICAL APPLIANCES; A. A. Low, Horseshoe, and H. Hertzberg, New York, N. Y. App. filed May 4, 1907. Curling iron in which breakage of the leading-in wires is prevented by a switch contact device arranged outside of the iron with which the wires connect and which permits rotation of the wires in handling the iron without twisting the wires.

913,846. MIXED DRIVE FOR AUTOVEHICLES; H. Pieper, Liege, Belgium. App. filed Nov. 23, 1905. A gas engine has connected thereto a dynamo motor and a storage battery in circuit with the latter, the parts so related that the dynamo motor may be run as a generator by the engine or as a motor by the battery. Provides a manually operated controller for the set and also an automatic controller, the former controlling the sparking advance and the latter preventing the battery from being overcharged and for regulating the volume of the explosive charges.

913,865. MULTIPLE-SWITCH STARTER; H. J. Wiegand, Milwaukee, Wis. App. filed May 20, 1907. Opens the motor circuit unless all of the resistances are removed from the circuit by means of a retaining means which holds the switches closed, including a magnet together with a switch for controlling the magnet which must be held by the operator during the closing operation of the former switches, in order to render the magnet effective.

913,888. ELECTRIC FURNACE; P. L. T. Heroult, La Praz, France. App. filed May 3, 1907. An electric furnace having a stationary terminal, an electrode, and means for shifting a face of the charge toward and from the electrode.

913,898. GALVANIC CELL; B. Jonas, Toledo, O. App. filed April 2, 1904. Arranges a plurality of porous jars, each containing an electrode in a plurality of tanks. The solution is pumped from an upper tank to a lower tank and back again so as to alternately empty and fill the cells with air, thus recharging the carbon elements of the cells with air, which acts upon the electrolyte, which in turn acts upon the iron element.



913,814—Means for Controlling Dirigible Torpedoes.

913,913. AUTOMATIC FUSE-BLOCK; C. O. Prowse, Hopkinsville, Ky. App. filed Sept. 25, 1907. Fuse-block and for subscribers' stations on telephone lines whereby when the circuit breaks through one fuse, it is restored through another after grounding the excessive current. A contact member is slidably mounted in a groove and a motor-actuated drum is provided connected by a cable with the contact member, to cause the above action.

913,931. TELEPHONE TRANSMITTER; C. Adams-Randall, New York, N. Y. App. filed April 14, 1905. For use with common battery systems and currents of high potential such as regulated electric light current. The transmitter has two or more independent disconnected elongated receptacles with granular resistance material therein, which can be connected in series to increase the internal resistance.

913,936. ELECTRIC BATTERY; L. P. Basset, Enghein, France. App. filed Sept. 30, 1907. An electric battery composed of thin plates of carbon with insulating material there between, the plates being perforated to permit circulation of two liquids there through, one liquid through the odd compartments and the other through the even compartments.

913,939. ELECTRICAL MEASURING INSTRUMENT; J. F. Begole, St. Louis, Mo. App. filed Feb. 10, 1908. Portable volt and watt meter having a receptacle for a translating device and a switch for varying the circuit so as to cause the instrument to operate either as a volt or as a wattmeter and so as to connect a resistance in series with the receptacle when used as a volt meter.

913,941. IONIZER OR APPARATUS FOR PRODUCING GASEOUS IONS; L. I. Blake, Denver, Colo. App. filed Nov. 17, 1908. Avoids the use of flames and discharge points by interposing between the plates of a condenser loosely packed glass wool, thus causing the entire space between the plates to glow and produce ions.

913,944. TELEPHONE TRANSMITTER; H. P. Clausen, Chicago, Ill. App. filed July 9, 1904. Relates to the granular carbon transmitter

contained in the usual box and provides resilient front and back metal auxiliary diaphragms suitably insulated so that the granular carbon, insulated from the box, will have no tendency to wedge between the resilient walls of the box and the backs of the electrodes.

913,947. TELEPHONE MOUTHPIECE; W. Gibson, Danbury, Conn. App. filed April 30, 1908. Made of glass with a cup-like shell inserted into the inner end thereof.

913,974. ELECTRIC SEMAPHORE SIGNAL; G. W. Pettey, Alexandria, Va. App. filed Sept. 21, 1908. The arms of the signal are revolved by an electric motor whose circuit is controlled by the train. Employs an open circuit, normal safety being indicated by a stationary condition of the arms and danger by the revolving of them. After a limited time the circuit is broken and the motor stopped after the train passes the crossing.

913,999. MULTIPLE-SWITCH STARTER; H. P. Wiegand, Milwaukee, Wis. App. filed May 20, 1907. A controller in which a plurality of hand-operated switches control a resistance and the motor circuit is opened unless all the switches are closed and all the resistances removed from the circuit. In order that the operator may not leave the starting resistance in circuit a switch controls the operating circuit of a low-voltage magnet which switch tends to move toward a position to render the low-voltage magnet inoperative and must be held by the operator to render it operative.

914,038. BATTERY-CONTACT; J. H. Gugler, Minneapolis, Minn. App. filed Feb. 21, 1908. Particularly for the negative electrode of the Bunsen cell in which the carbon electrode is provided with a well having a metal-electrode-plated surface containing mercury so as to form contact between a leading-in wire and said electrode.

914,042. GUARD FOR THE ARMS OF ELECTRIC-CONDUCTOR SUPPORTS; G. E. Harrison and G. Burns, Detroit, Mich. App. filed May 25, 1908. A sheath for the arms of supports for telegraph wires on which the lineman may stand to protect him from shock.

914,043. SAFETY-FUSE; G. W. Hart and F. D. Reynolds, Hartford, Conn. App. filed July 28, 1906. An inclosed fuse in a one-compartment casing with a conductor located between the outer and inner surfaces of the casing and an indicator visually indicating the condition of the fuse strip.

914,045. CORD CONNECTOR AND RACK; W. E. Hill, La Grange, Ill. App. filed Jan. 12, 1907. For redistributing the cords on telephone switchboards, including a longitudinal support, clamps movably mounted on the support and insulated cord connectors carried by the clamps.

914,046. COOLING DEVICE FOR THE ROTARY MEMBERS OF ELECTRIC MACHINES; J. Hissink. Berlin, Germany. App. filed Oct. 23, 1907. A rotary member includes a carrier having longitudinal grooves at its periphery, a metal ring surrounding the groove, wires on the outside of the ring, a cap surrounding the wires, the whole arranged for air cooling.

914,100. ELECTROLYTIC PROCESS OF PRODUCING COMPOUNDS; C. E. Acker, Niagara Falls, N. Y. App. filed March 6, 1907. For making cyanides of the alkaline earths by continuously electrolyzing a molten compound of the alkali metal, alloying the separated alkali metal with a cathode metal, removing and cooling the alloy, reacting thereon with ammonia, and on the resulting nitrogen compound at a higher temperature with a carbonaceous reagent, and returning the residual metal to the cathode.

914,107. WALL PLATE FOR ELECTRIC FIXTURES; I. Bond, Evanston, Ill. App. filed March 9, 1908. A cover plate with a central raised portion provided with an opening to receive the base of the switch.

914,172. ELECTRIC ALARM; T. Norpoth, St. Louis, Mo. App. filed June 12, 1908. A burglar alarm which operates when the burglar forces an entrance through a screen or when the box containing the alarm is forcibly removed.

914,173. ELECTRIC ALARM; T. Norpoth, St. Louis, Mo. A burglar alarm which may be placed on a chair and attached to the door knob by a cord so that when the door is opened the alarm rings.

914,177. SYSTEM FOR CONTROLLING THE STRENGTH OF DIRECT CURRENTS IN ELECTRICAL CIRCUITS; M. M. Osnos, Frankfort-on-the-Main, Germany. App. filed Oct. 29, 1907. For use in circuits in which the number of translating devices may vary within wide limits, at the same time keeping the strength of current the same. Provides a motor generator in which the generator is energized by a voltage taken from the motor portion, which is suitably varied by changing the strength of field that the voltage of the generator is decreased to maintain the current normal.

914,194. ANTISEPTIC LINING FOR MOUTHPIECES; M. Scroogs, New Orleans, La. App. filed Dec. 26, 1908. A detachable antiseptic lining, comprising an outer cup, an inner cup and an inner antiseptic cup between the former.

914,207. TROLLEY FROG AND CROSSING; F. J. Venning, Pittsburg, Pa. App. filed April 15, 1908. A frog having a pan and runways with a metallic wearing plate detachably mounted on the frog.

914,214. ELECTROLYTIC PROCESS OF PRODUCING NITROGEN COMPOUNDS; C. E. Acker, Niagara Falls, N. Y. App. filed Oct. 8, 1906. The process of forming nitrogen compounds which consists in continuously electrolyzing a molten alkali compound capable of forming nitrogen compounds, alloying the separating metal with a cathode metal, reacting on the alloy with a nitrogenous reagent, separating the products and returning the residual metal to the cathode.

914,235. SIGNAL; C. N. Brown, Richmondville, N. Y. App. filed Jan. 14, 1908. A signaling apparatus for domestic use for notifying tradesmen and provided with a controlling device at the operating point so that an identical signal is indicated at both operating and receiving point.

914,251. PROCESS OF CHLORINATING ORGANIC BODIES; C. Ellis, White Plains, N. Y., and K. P. McElroy, Washington, D. C. App. filed Jan. 12, 1906. Treats aromatic hydrocarbons, particularly the polycyclic forms of electrolyzing a chloride and causing the evolved chlorin to react upon the hydrocarbon so as to form derivatives of naphthalene.

914,301. STORAGE-BATTERY STAND AND MEANS FOR RAISING AND SUPPORTING PLATES, ETC.; O. H. Nelson, Highland Falls, N. Y. App. filed Oct. 16, 1908. For elevating and holding battery plates when cleaning the cell, including a stand, a removable cell support thereon and means for raising the plates slightly free from the cell to permit removal of the support and lowering the cell.

914,305. CAR-HEATER; E. J. Rauch, Taunton, Mass. App. filed Oct. 1, 1907. A water-circulating system on the car is heated by the resistance coil in the motor circuit.

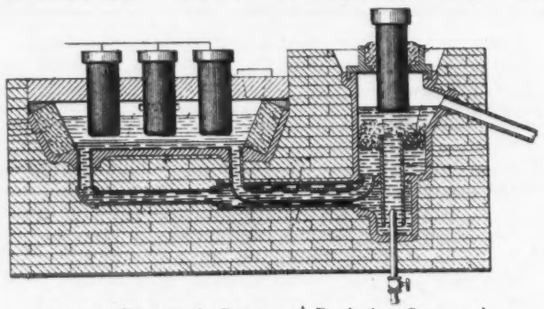
914,311. ELECTRIC-CURRENT GENERATOR; C. C. Ruprecht, Cleveland, O. App. filed July 28, 1905. A magneto generator provided with a pair of poles having a projecting portion carrying a winding with a rotary inductor within the winding and inductively arranged with relation to the winding and poles.

914,327. BINDING POST; C. Barbour, Pittsburg, Pa. App. filed May 16, 1908. A binding post that may be inserted in the terminal heads of cables having a body portion adapted to be inserted through the insulating wall of the cable head and carrying a locking part and a threaded stem.

914,338. TROLLEY HARP OR POLE; W. A. Dechant, Columbus, O. App. filed Aug. 6, 1908. A pole member having upwardly extending arms and a resilient connection between the arms which permit their separation under pressure, together with a roller on the arms having compression springs which are compressed when the arms are extended, the roller engaging a trolley wire.

914,342. STORAGE BATTERY; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed Nov. 28, 1902. Employs insoluble active materials in an alkaline electrolyte by providing a series of plates carrying pockets containing the active material and insulating means between the plates, preventing contact between adjacent plates and pockets.

914,343. PROCESS OF MAKING STORAGE-BATTERY ELECTRODES; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed March 30, 1905. The process of making storage battery electrodes



914,100—Electrolytic Process of Producing Compounds.

which consists in associating a mass of conducting metal particles in a honeycomb arrangement and subjecting them to a welding temperature to make them integral.

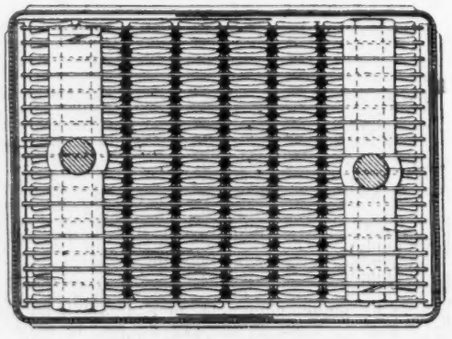
914,346. METHOD OF OPERATING ELECTRIC FURNACES; P. L. T. Heroult, La Praz, France. App. filed May 3, 1907. For varying the arc gap in arc furnaces or the degree of contact in incandescent furnaces, at the same time using a fixed electrode by shifting the face of the charge toward or from the electrode while holding the current terminals stationary.

914,354. FILAMENT FOR ELECTRIC GLOW-LAMPS; Kans Kuzel, Baden, Austria-Hungary. App. filed March 23, 1906. A filament for an electric glow lamp consisting of an alloy of tungsten with antimony.

914,355. ELECTRIC-CIRCUIT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed Nov. 30, 1901. A motor rheostat provided with a circuit breaker, a no-voltage coil controlling the circuit breaker, a control coil for the circuit breaker and a circuit contact closed by the movement of the resistance controlling element for controlling the control coil, thus avoiding damaging of the starting rheostat by permitting the contact lever to remain on the initial contact.

914,356. ELECTRIC-CIRCUIT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed Nov. 30, 1901. Avoids damaging the rheostat by holding the contact lever on the initial contact by providing a rheostat with a switch, an electro-magnetic actuating device therefor, with means whereby the switch is closed by the forward and backward movement of the movable element of the rheostat at the initial position.

914,357. ELECTRIC-CIRCUIT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed Nov. 30, 1901. Avoids damaging a rheostat by holding the contact lever on the initial contact by providing a



914,342—Storage Battery.

circuit breaker with a coil for holding it closed and a contact engaged by the resistance-varying element of the rheostat at or near its initial position for controlling the opening of the breaker by controlling the current in the coil.

914,365. SYSTEM FOR THE DISTRIBUTION OF ELECTRIC POWER FOR TRACTION PURPOSES; R. A. Weagant, Derby Line, Vt. App. filed June 8, 1906. An electrical conductor is automatically connected to and from a continuous conductor by the passage of the vehicle, through the action of a solenoid and core.

914,368. PROCESS OF FREEING RAW WOOL FROM ITS YOLK AND GREASE BY ELECTRICAL MEANS; J. M. Raudot, Tourcoing, France. App. filed June 8, 1906. Brings the wool into a bath and electrolyzes the bath by a current of low voltage to eliminate the grease.

914,372. PROCESS OF MAKING THIN METALLIC FLAKES; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed May 30, 1905. Subjects metallic granules to successive rolling operations and anneals them in an inner gas.